ASTM BULLETIN

Published by
AMERICAN SOCIETY for TESTING MATERIALS

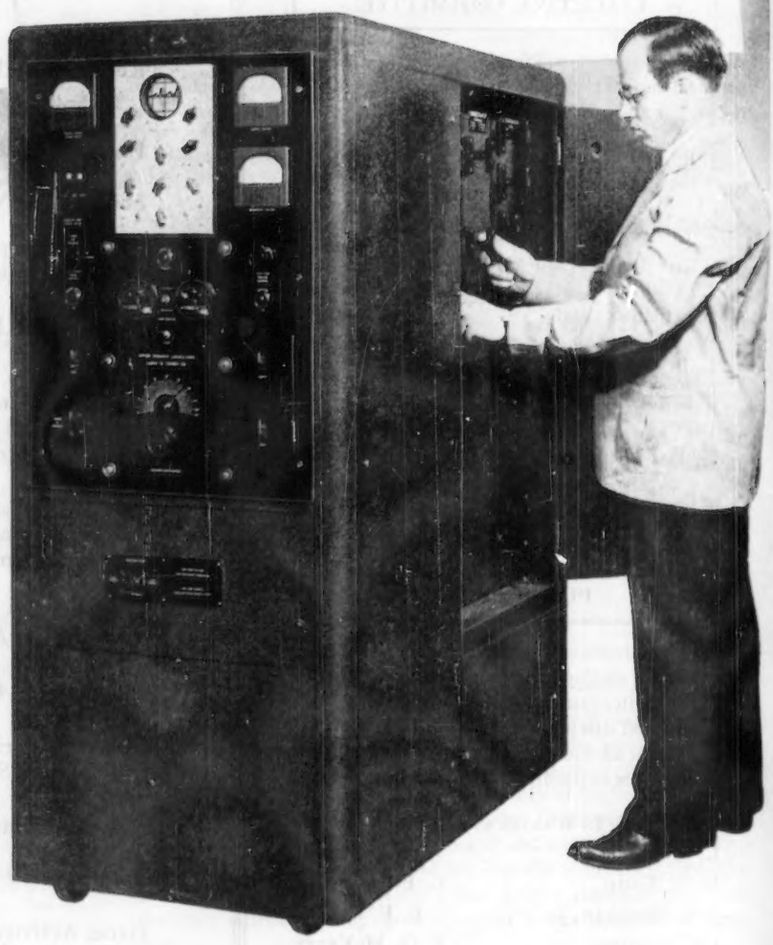
This Issue Contains

ASTM Bulletin, August 1944. Published six times a year, January, March, May, August, October, and December, by the American Society for Testing Materials. Publication Office—20th and Northampton Sts., Easton, Pa. Editorial and advertising offices at the headquarters of the Society, 260 S. Broad St., Philadelphia 2, Pa. Subscription $1.50 a year in United States and possessions, $1.75 in Canada, $2.00 in foreign countries. Single Copies—25 cents. Number 129. Entered as second class matter April 8, 1940, at the post office at Easton, Pa., under the act of March 3, 1879.

AUGUST—1944

No. 129

Here's How the MULTISOURCE Unit Enlarges the Scope of Analytical Control . .



1 Increases the scope of spectrographs by simplifications of spectrograms obtained by selecting an electrical discharge that produces fewer bands and spark spectral lines.

2 Increases the maximum concentration range of elements that may be analyzed with the spectrograph by selection of a spark-like discharge.

3 Increases the minimum concentration range of elements that may be analyzed with the spectrograph by selecting an electrical discharge for maximum sensitivity.

4 Increases the accuracy of spectrometric analysis through the precise control of each electrical discharge into the analytical gap of the spectrograph.

5 Increases the amount of power that may be delivered to the analytical gap of the spectrograph to completely burn the sample.

6 Increases the efficiency of the spectrographic laboratory because the Multisource Unit makes available all of the possible required types of electrical discharges that may be required for varied samples.

The complete mated line of ARL-DIETERT Spectrographic Equipment brings into the plant a reliable and fast spectrometric analytical control system that may be operated with a high degree of accuracy by plant personnel.

With each ARL-DIETERT unit is furnished a free training period in the operation and calibration technique by competent ARL-DIETERT Spectrographers.

ARL-DIETERT also maintains spectrographic laboratories for developing such special spectrometric test methods as may be required.

Our service is available whether your requirements are for a complete spectrographic laboratory or for single items such as Sampling equipment and Specimen Preparation equipment, Voltage Regulators, Excitation Units, High Voltage Selector Switch, Arc-Spark Stands, Optical Bench Equipment, Spectrograph, Film or Plate Developing equipment, Washing or Drying equipment, Comparator, Densitometer and Calculating Unit.

☆ Write for our catalog No. 128 giving complete description of the Multisource Unit and other ARL-Dietert Spectrographic Equipment. ☆

★ REASONABLE DELIVERIES. *Write for complete detailed information.* ★

CONTROL EQUIPMENT SAVES TIME

A.R.L. · DIETERT

APPLIED RESEARCH LABORATORIES
4336 SAN FERNANDO RD., GLENDALE 4, CALIF.

HARRY W. DIETERT CO.
9330 ROSELAWN AVE., DETROIT 4, MICH.

ASTM BULLETIN

"Promotion of Knowledge of Materials of Engineering, and Standardization of Specifications and Methods of Testing"

TELEPHONE—PENnypacker 3545 R. E. Hess, Editor CABLE ADDRESS—TESTING

R. J. Painter, Associate Editor

Number 129 August 1944

Record-Breaking Annual Meeting

Over 300 Committee Meetings; 2000 in Attendance; Notable Technical Program

PROBABLY NO one in his wildest imagination would have hazarded a prediction before the 1944 Annual Meeting that the registered attendance would have exceeded by more than 35 per cent the previous high. Yet a review of the complete technical program and the large list of standing committees which were to meet, would have indicated the wide diversity of work and might have justified a feeling that the meeting was to be a banner one in many respects. As noted in this article, there are a number of outstanding technical features of much significance and importance in the respective fields covered, and the continuing heavy attendance at meetings of the Society's technical committees bears ample evidence of the importance with which the materials engineering fraternity views A.S.T.M. activities.

No single article, or even issue of the BULLETIN, could adequately evaluate the complete meeting and activities, yet some attempts are desirable—to focus attention on various activities, and in particular for the information of many members who always find it difficult to attend the meeting.

RECORD-BREAKING ATTENDANCE

Even though attendance at a meeting is no criterion of its significance, the fact that despite travel conditions and crowded hotel conditions more than 2063 members, committee members, and visitors would attend the meeting, is worthy of some analysis. Actually, of course, a meeting in New York provides an opportunity for the heavy concentration of members there to attend, and this geographical situation extends to Philadelphia and to surrounding industrial communities. Thus we find that some 650 of the total registration was from the New York industrial area, compared with 300 for the Pittsburgh meeting in 1943; the Philadelphia District had almost 300 present compared with less than 200 in the previous year; Washington with 176 compared with 113 in 1943; and the New England States more than doubled their 1943 figure; these districts really accounting for a considerable portion of the 600 increase over 1943. The figures were up for every area except Pittsburgh, and of course with the 1943 meeting there it would be expected that the number registering in New York would be considerably less than at home. Other areas with marked increase in attendance were Buffalo and the Western New York-Ontario District and the Southeast.

Although the analysis of registration according to members, committee members, and visitors is not entirely accurate, there were some 1100 members, about 400 committee members who serve on the committees, but who are not affiliated with the Society, and about 550 visitors.

Regardless of how one analyzes the registration figures, a fundamental situation exists as our new President, P. H. Bates, points out in his message to the members later in this BULLETIN that the Society's widely diversified efforts are compelling factors which result in very active and well-attended meetings.

300 COMMITTEE MEETINGS

As the number of standing committees increases, obviously more technical meetings will be in prospect and one attending an annual meeting and seeing so many committee sessions under way might wonder how there is so much to do. Those who have had to arrange rooms and schedules of meetings in 1944 perhaps could be pardoned for sighs of relief that the more than 300 meetings, by and large went off successfully and with a minimum of friction as far as arrangements were concerned. On Tuesday and Wednesday of the week practically every nook and cranny available in The Waldorf was being used for meetings and several smaller ones were in progress on balconies around the Ballroom. Withal, the hotel did an excellent job of handling details.

With the technical committees really serving as the heart of the Society, their deliberations and recommendations are most important. Some notes on these appear in the following pages and members also have received in a separate mailing the *Summary of the Proceedings*, the purpose of which is to detail all important changes and additional recommendations made to the Society at the Annual Meeting by the various technical groups.

That committee work continues actively is apparent from reviews of reports and programs of work of which a summary is published later in this BULLETIN under a heading "Standardization Activities." Concerning new tentative standards approved at the meeting, three com-

New President
P. H. Bates

mittes in the "D" group were each credited with over ten items—D-1 on Paint, Varnish, Lacquer, and Related Products; D-6 on Paper and Paper Products; D-20 on Plastics.

Technical and General Sessions

Technical features of the meeting included the Nineteenth Edgar Marburg Lecture, on "Textile Fibers—an Engineering Approach to an Understanding of Their Properties and Utilization," by Dr. Harold DeWitt Smith, a guest address on "Minerals in War and Peace," by Dr. Charles K. Leith, and the Symposium on Analytical Colorimetry and Photometry in which some 15 authorities discussed apparatus and equipment available and the applications of various methods in such fields as ferrous alloys, aluminum- and magnesium-base alloys and others. Over 400 attended each of the two symposium sessions.

Other outstanding technical "treats" at the meeting were the round-table discussion on organizing the classification of industrial waters; the session featuring plastics, timber, rubber; the round-table discussion on centrifugal castings; and sessions on concrete and cementitious materials, and on non-ferrous metals and alloys. While the number of formal technical papers presented was somewhat less than in previous years, only an actual count of the items would make this apparent since the papers in each of the sessions were interesting and timely and the method of presenting committee reports now in effect makes these presentations interesting to hear and keeps to an absolute minimum the "dry" material which involves specification details. Notes on some of the technical sessions appear below.

The so-called "general session" on June 30 was featured by the President's Address, Dr. Leith's very interesting guest address, and the award of Honorary Memberships and Forty-Year Membership Certificates. As a surprise feature two of the Society's long-time officers also received awards. Notes on these activities follow.

President's Address

The annual address of the retiring president, Dean Harvey, discussed "The Art of Being a Materials Engineer." The selection of this topic was justified on the basis that work on properties and testing of materials, and, in fact, all advances in technology and engineering, rest upon the efforts of the individual. Stressing the necessity of cooperation, he pointed out that modern industry is based on cooperative efforts of men, and then successively he discussed such qualities as enthusiasm and loyalty and dwelt on the necessity of technical men having the ability to express their thoughts clearly and concisely, whether by the spoken or written word. Considerable portions of the address related to the preparation of specifications and methods of testing, covering these topics because they must some time or other be of concern to every materials technologist. He concluded, "We are all partners in the great enterprise of making this world a better place in which to live. This includes our own personal relations with each other, our duties as citizens, our activities in our respective companies, and our association together in the A.S.T.M."

Marburg Lecture on Textile Fibers

In a most interesting lecture of interest to textile technologists and to materials engineers generally, Dr. Harold DeWitt Smith of A. M. Tenney Associates stressed the importance of an engineering approach to properties in utilization of fibers. Broadly he covered two purposes—the first providing the nontextile man with information about fibers as engineering materials stressing the necessity of realizing that the mechanical behavior of these tiny microscopic beams which we call textile fibers is of primary importance alike to the strength of a hawser or a pneumatic tire, the comfort of an overcoat or of a summer suit, the utility of a carpet or a child's play dress, and, last and most important, the elegance and beauty of a well-filled evening gown! Secondly, he wished to inspire the textile mind, whether it be that of the designer, the fabricator, or the technologist, with the new philosophy of textiles which has been created by the advent of manufactured fibers. The essence of this new philosophy is that fibers can be designed to meet specific textile wants. Textiles made of the thirty-odd natural and present-day manufactured fibers occupy the foreground. Beyond this foreground is the wide and exciting horizon of the future in which the only real limitations on the variety and the characteristics of textile fabrics yet unborn will be the ability of the textile designer and technologist to help the fiber maker to understand what kinds of fibers are wanted. This is an engineering job, for the engineer

New Vice-President
Arthur W. Carpenter

stands midway between the scientist and the craftsman.

As announced later in this BULLETIN in an article on Publications, the 1944 Lecture will be published separately (about October 15) before its inclusion in the 1944 *Proceedings*.

SYMPOSIUM ON ANALYTICAL COLORIMETRY AND PHOTOMETRY

This symposium, organized by A.S.T.M. Committee E-3 on Methods of Chemical Analysis headed by Dr. G. E. F. Lundell, National Bureau of Standards, with the Symposium Committee headed by D. R. Evans, Western Electric Co., provided both new and older material on a subject which has been of very decidedly growing interest as evidenced not only by the heavy attendance at the two sessions, but by the volume of new material presented. For example, J. W. Stillman, in his Bibliography on Colorimetric Methods shows a considerably higher percentage of current papers on the subject than for previous periods. The symposium was arranged in two sections, one on "Instruments," with the second involving "Applications of Various Methods." It was evident that although there are many excellent instruments in the field at the present time, with the return to normalcy, chemists can expect marked improvement from the apparatus standpoint. The symposium provided an excellent résumé of basic fundamentals underlying the colorimetric and photometric chemical applications, which stressed the possibilities of existing equipment and new instruments in development. The committee in charge of the symposium expects to release most of the discussion and papers in the symposium for publication in a special pamphlet that it is hoped will be ready for distribution late in 1944.

CENTRIFUGAL CASTINGS

A very interesting and successful round-table discussion on centrifugal castings, sponsored jointly with the American Foundrymen's Association, was another feature of the Annual Meeting. Several hundred attended the session and heard prepared discussions as well as informal comments and discussion from the floor. Norman L. Mochel, Westinghouse Electric and Manufacturing Co., who headed the committee in charge, presided. Problems of quality control, specifications, and methods of evaluation, and testing angles were the chief topics, these being related to the various materials fields covered, in particular, ferrous metals. Applications were described where centrifugally cast parts may be widely applied. Col. Zornig of Watertown Arsenal discussed in an interesting way developments and problems in connection with gun forgings and related parts, Mr. Mochel covered some of the problems from the consumers' standpoint, and other leaders in the field, including John Howe Hall, J. T. MacKenzie, T. S. Quinn, and A. E. Schuh, gave interesting and helpful information. A general résumé of the session is being prepared and this will be the only material published.

Address

Members of the Society and others who would be interested in receiving a copy of the annual address of the retiring president, Dean Harvey, can obtain one by writing A.S.T.M. Headquarters.

1944 Edgar Marburg Lecturer Dr. H. De Witt Smith, with C. L. Warwick, Secretary-Treasurer, left, and Past-President Dean Harvey, right.

MINERALS IN WAR AND PEACE

In his guest address at the general session June 28, Dr. C. K. Leith, Minerals Consultant to many government agencies, discussed minerals as vital raw materials for industry and for armament and as controversial international problems. When we realize that the world has used more minerals in the last three or four decades than in all preceding history, we can see that the problems involved are really new in human affairs. He cited an almost incomprehensible increase in use of minerals in the present war, but with the job of mineral procurement for the present pretty well done, attention is being focused on post-war plans. No nation has enough of all minerals, and the United States' dependence on the foreign supply will continue to grow. The Atlantic Charter enunciated the principle of equal access to raw materials, but there are difficulties in working out the program. Disarmament requires some control of the raw materials necessary. Among the problems are raw materials sanctions, stockpiling minerals which are deficient in the United States, and the evolution toward large units of control, which he indicated were backed by such compelling reasons as efficiency, conservation, and others.

For Dr. Leith's address, which, however, does not include his discussion on some interesting current problems, see later pages of this BULLETIN.

WATER FOR INDUSTRIAL USES

The Round-Table Discussion on Organizing the Classification of Industrial Waters developed by A.S.T.M. Committee D-19 featured four technical papers and an interesting introduction, the latter by Dr. W. C. Schroeder. He stressed the necessity of removing in so far as possible the mystery surrounding water treatment and then outlined the basis for determining and recording water char-

acteristics in common terms which in essence involves a comparison of the water in question and its chemical makeup with nine standard samples that have been developed by the A.S.T.M. committee. These nine samples described in a paper by W. D. Collins represent typical waters encountered in the operation of industrial establishments. Complete analysis of these have been made and with their use there is offered a tool for expressing the meaning of water analysis in understandable language.

Graphitization of Steel Piping

One of the interesting events at the meeting was an open session sponsored by Project Committee 29 on Graphitization of Carbon-Molybdenum Steel Pipe, functioning as a research project of the A.S.T.M.-A.S.M.E. Joint Research Committee on the Effect of Temperature. Arranged by J. J. Kanter, members of Committee A-1 on Steel and others interested were invited to attend and discuss this important and perplexing problem on which several research investigations are under way, and which has caused much concern to those who are using piping materials at elevated temperatures, particularly, of course, in the electrical generating field. In addition to an interesting paper on "Investigation of Graphitization of Piping," by H. N. Boetcher, there was discussion by a large number concerned with this field, including Messrs. Sabin Crocker, S. L. Hoyt, H. J. Kerr, R. H. Aborn, A. E. White, and N. L. Mochel, the latter, chairman of the Joint Committee. It is anticipated that Mr. Boetcher's paper will be published, and with this abstracts of the discussion. Reference is made elsewhere in this Bulletin to a publication on Graphitization of Steel Piping issued by The American Society of Mechanical Engineers.

Standardization and Research

Some indication of major accomplishments in various fields of standardization activity appear later in this Annual Meeting article, and what the immediate future may have in store on new specifications and tests is indicated in a specific article. In evaluating annual meeting accomplishments, it is desirable first to consider new tentative standards which probably are the most significant statistics. For the past several years, the number of new tentative standards, which are proposed standards published for a year or more for comment and criticism before publication as formal standards, has been upwards of 50, and it will be noted from the table below that 61 were accepted this year. Constantly, existing standards and tentative standards are being revised. This figure varies greatly, but is usually high in the year when the Book of Standards is being issued, such as this year. Years ago, the Society's policy on the adoption of existing *tentative* standards as formal standards was to hold most of these actions for the year in which the Book of Standards was published, but a review of actions in recent years would indicate a large number of adoptions each year, in line with the intensified tempo of our standards work.

The data given in the accompanying table are of interest, particularly the totals, but with the Society's Committee E-10 on Standards meeting late in August, and more or less constantly throughout the year accepting new tentative standards or revisions, the totals constantly require revision upwards.

Many members are interested in the serial designations given new tentative standards—these are afforded by an article in this Bulletin. Members may wish to keep this page for ready reference.

In a separate mailing, there is being sent to each member a letter ballot covering those actions involving the adoption of standards or changes in existing ones, this ballot being accompanied as customarily by the *Summary of Proceedings* which gives detailed information on matters covered in the ballot, particularly any changes made at the meeting.

Research:

A review of the committee reports presented at the Annual Meeting plus consideration of numerous technical papers relating to the work indicates a continuance of the tremendous outpouring of authoritative information and data on the properties of materials, much of this coming from formal research projects which are under way; for example, the report of the committees in the field of corrosion—A-5 on Ferrous, B-3 on Non-Ferrous, and B-8 on Electrodeposited Coatings, etc.—provide very extensive and valuable material from inspections of the country-wide atmospheric tests and other tests, many of which have been under way for a number of years. The Society's work in research involves all levels of activity, formal, informal, round-robin projects with only three or four laboratories participating, more extensive ones with

(*Continued on page 10*)

SUMMARY OF ACTIONS TAKEN AT ANNUAL MEETING AFFECTING STANDARDS AND TENTATIVE STANDARDS.

	Existing Tentative Standards Adopted as Standard	Standards in Which Revisions Will Be Adopted	New Tentative Standards	Proposed Revisions of Existing Standards Accepted as Tentative	Existing Tentative Standards Revised	Standards and Tentative Standards Withdrawn	Present Total Standards Adopted	Present Total Tentative Standards
A. Ferrous Metals—Steel, Cast Iron, Wrought Iron, Alloys, etc.	7	43	2	4	12	6	159	32
B. Non-Ferrous Metals—Copper, Zinc, Lead, Aluminum, Alloys, etc.	2	12	4	2	41	..	66	96
C. Cement, Lime, Gypsum, Concrete, and Clay Products	14	16	14	3	6	2	138[a]	39
D. Paints, Petroleum Products, Paper, Textiles, Rubber, Soap, etc.	56	34	45	10	43	2	435	214
E. Miscellaneous Subjects, Testing, etc.	1	...	..	..	2	..	21	30
Total	80	105	65	19	104	10	819	411

[a] Includes 7 standards, resulting from the division of the Standard Methods of Sampling and Physical Testing of Portland Cement (C 77) into separate methods covering the component parts.

J. T. MacKenzie | Sam Tour | J. G. Morrow | W. C. Hanna | L. B. Jones

NEW OFFICERS

THE RECENT ELECTION of officers, as announced at the annual meeting by the tellers, T. G. Stitt and F. C. Smith, resulted in the unanimous election of P. H. Bates, as President (1944–1945), Arthur W. Carpenter as Vice-President (1944–1946), and the following as members of the Executive Committee (1944–1946): W. C. Hanna, L. B. Jones, J. T. MacKenzie, J. G. Morrow, and Sam Tour.

PRESIDENT

P. H. Bates, the new President, Chief, Clay and Silicate Products Division, National Bureau of Standards, Washington, D. C., after graduating from the University of Pennsylvania, class of 1902, became Assistant Chemist, Pennsylvania Railroad, serving until 1906. While at Altoona he was associated with the Society's first president, Charles B. Dudley, then Chief Chemist of the Pennsylvania, and also with F. O. Clements, A.S.T.M. President, 1931–1932. He then became Chemist, Technologic Branch, U. S. Geological Survey, at St. Louis, and from 1910 to 1919 was in charge of the Pittsburgh Branch of the National Bureau of Standards. During the next two years he was Chief, Structural Miscellaneous Materials Division, at the Bureau and also Acting Chief, Ceramic Division. He has been in his present position since 1921.

Mr. Bates has been chairman of A.S.T.M. Committee C-1 on Cement since 1926 and has been active in other Society work. He is a past-president of the American Concrete Institute, and was awarded the Turner Medal by the Institute in 1939 for contributions to science, direction of research, and outstanding leadership in advancing the intelligent utilization of cement and concrete. In 1940 he was the A.S.T.M. Edgar Marburg Lecturer on the subject "Portland Cement—Theories (Proved and Otherwise) and Specifications." He was a member of the Executive Committee from 1937 to 1939 and Vice-President, 1942 to 1944.

VICE-PRESIDENT

Arthur W. Carpenter, Manager, Testing Laboratories, The B. F. Goodrich Co., Akron, Ohio, received his B.S. degree in Chemical Engineering from the Masssachusetts Institute of Technology in 1913; M.S., 1914. He was City Chemist, Alliance, Ohio, and Chemist of Akron Municipal Water Purification Plant; served overseas in World War I; and was then affiliated with The Goodyear Tire and Rubber Co. and with Holtite Manufacturing Co., Baltimore, as Superintendent. Returning to Goodyear as Development Compounder, 1923–1926, he has since been with The B. F. Goodrich Co., in his present position from 1928.

Mr. Carpenter has been particularly active in the work of A.S.T.M. Committee D-11 on Rubber Products, having been Secretary since 1928 and a member of more than ten of its subcommittees including the Advisory Committee. He served two years on the Society's Committee on Papers and Publications, is Vice-Chairman of the Cleveland District Committee, a member of Committee E-9 on Research and served on the A.S.T.M. Executive Committee from 1931 to 1933, and again from 1941 to 1943. For about a year he was a consultant in the WPB Conservation Division. He is a member of the American Institute of Chemical Engineers, American Chemical Society, and Fellow of the American Institute of Chemists.

MEMBERS OF EXECUTIVE COMMITTEE

W. C. Hanna, Chief Chemist and Chemical Engineer, California Portland Cement Co., Colton, Calif., a native of Colorado, began his industrial work with the California Portland Cement Co. in 1903, becoming a member of the Society soon after. He was the ninth A.S.T.M. member from that area where his company was the pioneer cement-producing organization. He attended Pomona College in California taking special work. Mr. Hanna has been particularly active in A.S.T.M. committees in the field of cementitious materials—C-1 on Cement, C-7 on Lime, the Committee on Concrete, and others. Probably his most notable contributions have been as chairman of the Committee on Chemical Analysis of Cement. He is active in civic affairs in Colton and is a member of a number of technical organizations including the American Institute of Chemical Engineers, American Chemical Society, American Concrete Institute. His hobby is the study of ornithology with over 20,000 eggs in his museum. He has completed a term as chairman of the Southern California A.S.T.M. District Committee.

L. B. Jones, Engineer of Tests, Test Department, The Pennsylvania Railroad Co., Altoona, Pa., graduating from Cornell University in 1904 with the M.E. degree, after brief service with the Westinghouse Electric and Manufacturing Co., the Electric Storage Battery Co., and the Reading Railroad Co., began his extensive service with the Pennsylvania Railroad Co. as a Special Apprentice. Subsequently he was Enginehouse Foreman, Assistant Engineer of Motive Power, Master Mechanic, and Engineer of Tests. In addition to the normal duties of these positions, he devoted considerable time to the early development of locomotive stokers; coal handling and car dumping machinery; and shop design and facilities, and has been granted United States Patents on a number of locomotive and track accessories. He has been active in the work of Committees A-1 on Steel (Advisory and several subcommittees), and A-2 on Wrought Iron, and is one of the six members of the important Committee E-10 on Standards. He is a member of Sigma Xi, the American Association for the Advancement of Science, the American Society of Mechanical Engineers, and is active in the work of technical committees of the American Association of Railroads.

J. T. MacKenzie, Chief Metallurgist, American Cast Iron Pipe Co., Birmingham, Ala., a graduate of the University of the South (Sewanee) in Tennessee, received his B.S., C.E., and M.A. degrees, and later his honorary degree of D.Sc. (1930) from that institution. He has been associated with his present company for many years, as Analyst 1912–1914; doing research work for a year (1914–1915); Metallurgist and Chief Chemist, 1915–1939; and since 1939 has served in his present capacity as Chief Metallurgist. He has been very active in A.S.T.M. serving a prior term as a member of the Executive Committee, 1932–1934, and is a member of numerous technical committees, especially concerned with Committee A-3 on Cast Iron and E-3 on Chemical Analysis of Metals. He has prepared a number of technical papers published in the Society's Proceedings, and has cooperated in connection with symposiums and discussion. Mr.

MacKenzie has been especially active in the work of the American Foundrymen's Association (Whiting Medallist, 1937; Honorary Member, 1937; British Exchange Author, 1927 and 1938); and also is affiliated with the American Institute of Mining and Metallurgical Engineers (Chairman, Iron and Steel Division, 1938; Howe Memorial Lecturer, 1944), the Electrochemical Society (Chairman Electrothermic Division, 1932, 1943, and 1944), American Ceramic Society, the Iron and Steel Institute (British), and the American Chemical Society.

J. G. Morrow, Chief Metallurgist, The Steel Company of Canada, Ltd., Hamilton, Canada, a native of Hamilton, Ontario, attended the Hamilton Public Schools, later the Collegiate Institute specializing for four years in chemistry, and his headquarters have been maintained in Hamilton since then. His work with the Steel Company of Canada began in 1905 as Chemist; later he was Inspecting Engineer and has been Chief Metallurgist and Inspecting Engineer for many years. Very active in the work of the Canadian Standards Association, he has been for some time chairman of that body. During the present war he has served as Technical Adviser to the Steel Controller, Department of Munitions and Supply, Ottawa, and Chairman of the Technical Advisory Committee on Alloy and Special Steels. He is Vice-President of the Atlas Plant Extension, Ltd., a Crown Company incorporated to augment Canada's supply of alloy steel and gun forgings. Also he has been a member of the Administrative Committee of the War Production Board National Emergency Steel Specifications project serving on several of the technical advisory committees. He has been a member of A.S.T.M. for many years concerned especially with the work of Committee A-1 on Steel. His other technical affiliations include The Canadian Institute of Mining and Metallurgy, American Iron and Steel Institute, Society of Automotive Engineers, The American Wire Association, and Association of Professional Engineers of Ontario. His hobby is yachting.

Sam Tour, President Sam Tour and Co., Inc., New York, N. Y., graduating with honors in chemical engineering from the University of Colorado (his native city was Colorado Springs), received the degree of M.S. from the University of Michigan where he taught in Chemical Engineering. From 1917 to 1921 he was in the Metallurgical Section of the Ordnance Department, U. S. Army; then for seven years he was Metallurgist with the Doehler Die Casting Co. and later was Consulting Metallurgist concerned with die casting, wire drawing problems. From 1929 to 1943 he was Vice-President of Lucius Pitkin, Inc., Consulting Metallurgists and Chemical Engineers, and for three years in the present war was Director of the Laboratory at Frankford Arsenal. Last year he formed his own company, concerned with metallurgical problems and consulting work. He has been very active in A.S.T.M. committees as chairman of B-3 on Corrosion of Non-Ferrous Metals and Alloys, and B-7 on Light Metals and Alloys, Cast and Wrought, and serves on several other groups in the non-ferrous field. He has prepared a large number of technical papers and reports and has served as chairman of technical groups in many other societies, including the American Institute of Mining and Metallurgical Engineers (Past-Chairman, Institute of Metals Division); American Foundrymen's Association (Chairman, Non-Ferrous Division); American Society of Metals (Chairman, Washington and New York Chapters). Mr. Tour holds membership in several other technical groups.

Annual Meeting

(*Continued from page 8*)

20 or 30 taking part, this work varying according to the complexity of the problem, scope, etc.

Later in the year, Committee E-9 on Research will doubtless continue its publication of a review of research projects, indicating those which have been recently initiated and noting those where much progress has been recorded during the year.

Steel; Corrosion of Iron and Steel

At this session many important changes were approved in steel specifications particularly in the field of pipe and tubing where new marking requirements are being established and modifications in certain physical property requirements are being effected. In particular, austenitic grades of steel, straight 18 per cent chromium, 8 per cent nickel, and as modified with titanium and columbium, were changed to be in line with latest practice, and at the same time the committee took action to recommend emergency alternate provisions in these grades. All recommendations in the Committee A-1 report were approved, except the one involving music wire (A 228) which suggested an increase in phosphorus and sulfur. Because of negative votes, this was withdrawn.

There was intensive discussion on methods of magnetic particle testing of forgings and castings, and with two proposed standards practically completed, references to the methods applicable were approved for incorporation in several steel casting specifications.

An important part of the report submitted to the Society by Committee A-5 on Corrosion of Iron and Steel was the record of observations in the extensive tests of metallic coatings on hardware, structural shapes, tubular goods, etc. The report includes a brief definitive summary of the performance of the coatings. In the galvanized sheet exposure tests, there was an increasing number of failures and perforations during the past few months, and the A-5 report gives a record of the latest perforations.

An important recommendation in this report which was approved is the new standard for lead coatings (hot dip) on iron and steel hardware. Essentially this incorporates the requirements in the former emergency specification ES-2.

Metallography

In the extensive revisions approved in the widely used methods of preparation of metallographic specimens (E 3), particular attention was paid to the incorporation of the latest and best recommendations pertaining to the more recent practices in electrolytic polishing. Several changes in line with modern practice and equipment were approved in the methods of preparing micrographs of metals and alloys. The report of Committee E-4 also noted the paper by P. F. George on "A Numerical Rating Method for the Routine Metallographic Examination of Commercial Magnesium Alloys," presented at the annual meeting and another by R. P. Loveland on "Metallography in Color," the latter published in the May ASTM Bulletin.

Effect of Temperature on the Properties of Metals

Two interesting progress reports were included in the material presented to the Society by the Joint A.S.T.M.-A.S.M.E. Research Committee on the Effect of Temperature on the Properties of Metals, the first covering the effects of variables on the creep resistance of steels, which is part of a long-time program. It covered particularly the effect of heat treatment on a silicon-killed and silicon-aluminum steel of the 1015 type. The other report included a correlation of short-time and long-time elevated temperature tests, which indicated among the conclusions that the best correlations were obtained from the following tests: Sustained load tension test; Hatfield time-yield test; DIN (DVM) test.

Non-Ferrous Metals and Alloys

The importance in the war effort of copper and copper alloys is recognized and A.S.T.M. Committee B-5 which covers copper and copper alloys both cast and wrought, has had a very busy time keeping the specifications in line with important changes

in supply, quality of materials, and other emergency conditions. Numerous emergency provisions have been issued and a great many of the specifications have been modified from time to time. At the recent Annual Meeting 25 tentative specifications were revised and changes in ten formal standards were approved for submission to ballot for immediate adoption. Many of the changes involved chemical requirements, a number have included provisions that were issued as emergency but now are considered suitable for regular use; and in a number of the wrought specifications tolerances and permissible variations have been incorporated.

Related to the work on non-ferrous castings was a paper by A. J. Smith describing the evolution of test specimens for properties of castings. As a result of his extensive studies and other work carried out by members of the A.S.T.M. technical committees, he concludes that some of the test bars are not on a very sound premise and that organizations concerned with quality of various non-ferrous castings should develop a bar which would be a reasonable and economical sample and represent the metal from which the lot of castings is made. He advocated a symposium on this subject.

Corrosion of Non-Ferrous Metals and Alloys

An extremely important contribution in the report of Committee B-3 on Corrosion of Non-Ferrous Metals that is of interest to all producers and users of these materials is the report on the atmospheric corrosion tests comprising data gathered from tension and weight loss determinations made on specimens that have been on exposure in various atmospheres for about ten years. The data are worthy of study by every non-ferrous metallurgist and materials technologist and although the committee as such does not feel it desirable to evaluate the significance of the percentage changes, it is arranging for the presentation of several technical papers by individuals who have had a prominent part in the work and who are authorities in the field, such a procedure permitting a more full and free discussion than would be possible by the committee as a whole. Several new investigations are described in the report.

Die-Cast Metals and Alloys

Committee B-6 announced the approval of its emergency specifications for controlled quality magnesium-base alloy die castings which cover materials for applications where breakdowns would be extremely serious. In addition to detailed chemical and physical requirements, the latter calling for periodic break-down tests, X-ray controlled production is specified.

Magnesium Alloys

A code for identifying magnesium-base alloys which follows the system of aluminum-base materials has been adopted by A.S.T.M. Committee B-7. Letters are used to designate alloy constituents, with numbers used for the approximate compositions.

Electrodeposited Coatings

Detailed in the annual report of Committee B-8 are its extensive atmospheric exposure tests of electroplated lead coatings on steel which involve 148 panels at each of four exposure stations: New York City, State College, Pa., Wilmington, N. C., and Tela, Honduras. The committee indicated it has begun a survey of current practices of preparing high-carbon steel for electroplating, and that another group is investigating the mechanism of corrosion through pores.

Cement and Concrete

Two interesting and full sessions covered cementitious and masonry materials.

The extensive report of Committee C-1 on Cement included recommendations on a new test for determining air content of mortar, determining vinsol resin, and a test for heat of hydration. Among the important specifications changed were those covering treated portland cement for pavements (C 175) which is now changed to cover air-entraining portland cement. Requirements permit the addition of Darex, an air-entraining material, studies of which are detailed in the report. Certain modifications and strength requirements have been incorporated in the standard portland cement specifications (C 150).

For convenience and utility, the widely used methods of sampling and physical testing portland cement (C 77) have been divided into the respective methods covering fineness, soundness, time of set, etc.

The paper by Messrs. Wuerpel and Weiner discussed the reaction of vinsol resin in concrete and is to be published in the October Bulletin.

An interesting paper prepared by E. V. Barrett of Venezuela gave comparative tests of 52 brands of cement from 15 different countries. He concluded that most of the brands of cement complied with A.S.T.M. specifications and that several of the countries produced excellent quality material. The water cement ratio–stress relationships varied widely.

G. J. Fink in discussing "The Effects of Certain Variations in Consistency and Curing Conditions on the Compressive Strengths of Cement-Lime Mortars" stated, "The results show that, with two exceptions, the 28-day strengths of the cement-lime mortars of 75 per cent flow were higher than those of the mortars of 110 per cent flow, the differences increasing with the increasing cement content. The reverse was true in the case of the straight lime mortars.

"The results of the tests indicate the need for further information on the effects of variations in the damp-closet conditions and of the moisture content at the time of test on the compressive strength of specimens of the various mortars, and additional tests which should contribute further data are under way."

Concrete

A number of interesting papers featured the A.S.T.M. session on concrete which also included the report of Committee C-9 with its several important recommendations involving various specifications and, more particularly, tests. Part of the report was a discussion by J. C. Pearson on "Volumetric Method for Determining the Air Content of Freshly Mixed Concrete." The method was carefully compared with the existing standard and and apparently gave nearly as dependable results with considerably less time and less computation involved. The effect of entrained air in concrete was covered in a paper by H. L. Kennedy, who stressed the fact that it is the air entrained in the fine aggregate which is responsible for the enhanced properties of concrete. He pointed to the danger of excessive entrained air which might result in reduction in cement content to the possible detriment of other properties than resistance to freezing and thawing.

Discussing measurement of strength by pull-out bars, Bailey Tremper, Materials Engineer, State of Washington Department of Highways, concluded from extensive investigations that pull-out tests can be reproduced within limits that are nearly as close for compression tests.

Messrs. Duke and Davis presented the results of laboratory investigations on the creep of concrete under combined stresses. Most of the tests were conducted on 8 by 16-in. cylinders, using three different ratios of axial to lateral stress. They developed a proposed method for estimating the amount of creep under combined stresses from the results of measurements of creep under simple axial compression. Changes in cement gel structure induced by the applied water pressure may be responsible for differences in estimated and measured creeps at later times it was noted.

Mortars and Masonry Units

The principal item in the report of Committee C-12 was a revised specification for mortar for reinforced brick masonry which provides property or proportion specifications. The

changes include added requirements relating to quality of materials, such as limitations on the use of admixtures and antifreeze compounds, and the addition to the proportion specifications of volume proportions for the convenience of the user.

In addition to specifications for building brick and concrete masonry units and various methods of testing, Committee C-15 has developed a tentative standard for glazed building units which were rather extensively revised at the Annual Meeting. Changes include tolerances on dimensions and warping requirements, and data for ceramic units of two grades and two types.

Petroleum Products, Road Materials

The annual report of Committee D-2 on Petroleum Products and Lubricants was extensive with several revised tentative methods of test published in their new form. These covered determination of acid and base numbers by color-indicator titration (D 663) and by electrometric titration (D 664); rust-preventing characteristics of steam-turbine oils (D 665); and aniline point (D 611). An accelerated test for potential gum measures the quantity of [illegible] gasoline has been oxidized for a specified time under prescribed conditions. The report gave results of cooperative determinations of sulfur in petroleum oils and also extensive cooperative data obtained by using new emergency methods of determining chlorine, phosphorus, lead, and metals in lubricating oils, ES–36 through ES–39.

In view of the extensive discussion, reports, and several technical papers published in recent years on methods of recovering bitumen from asphaltic mixtures Committee D-4's new test covering hot extraction of asphaltic materials and recovery of bitumen by the modified Abson procedure was of interest. Tables of substantiating data were included in the report.

Paint, Varnish, Lacquer, and Related Products

Among the important recommendations approved by the Society as a result of work of Committee D-1 on Paint, Varnish, etc., were seven specifications covering the following types of pigments: Raw Umber, Burnt Umber, Raw Sienna, Burnt Sienna, Venetian Red, Yellow Iron Oxide Hydrated, and Black Synthetic Iron Oxide. These specifications follow the system used in a large number of other pigment specifications covering composition and properties, number of tests and methods to be used. Added to the series of tests for evaluating serviceability of various types of paints and paint products is the test for degree of flaking (scaling) of exterior paints of the linseed oil type. This involves a series of photographic reference standards which are primarily for comparative evaluation.

Paper and Paper Products

Committee D-6 on Paper and Paper Products shares with two other A.S.T.M. standing committees (Plastics and Paints) the distinction of submitting the most new tentative standards at the 1944 Annual Meeting. The 11 new standards for testing various types of paper and paper products have been developed after intensive work, much of it in cooperation with T.A.P.P.I. New methods cover the following:

Adhesiveness of Gummed Tape, Bursting Strength of Paper, Drop Tests for Shipping Containers, Effect of Heating on the Folding Endurance of Paper, Flammability of Treated Paper and Paperboard, Hydrogen Ion Concentration (pH), Penetration by Water of Sized Paper and Paper Products (Dry Indicator Method), Printing Ink Permeating of Paper (Castor Oil Test), Puncture and Stiffness Testing of Paperboard, Corrugated and Solid Fiberboard, Testing Containers in the Small Revolving Hexagonal Drum-Box Testing Machine, and Water Vapor Permeability of Paper and Paperboard.

The report indicated that extensive work is continuing on a number of other tests and work on fiberboard containers will continue active.

Committee D-6 announced the completion of the extensive monograph on "Paper and Paperboard, Characteristics, Nomenclature and Significance of Tests." It will include a discussion of paper manufacture and the nature of paper from the chemical standpoint and as a complex structure; also a detailed discussion of the properties of various classes of paper and paperboard. The individual tests applied to paper and paperboard and their significance are also discussed at considerable length. (Note.—This should be available in the next few weeks.)

Timber

Committee D-7 on Timber in its report featured proposed methods of testing veneer, plywood- and wood-base laminated materials. An important new subcommittee on fire-retardant

June Meeting of A.S.T.M. Executive Committee: From l. to r. (clockwise): M. H. Bigelow, E. W. McMullen, Arthur W. Carpenter, J. H. Foote, G. E. F. Lundell, J. G. Morrow, L. H. Fry, W. C. Hanna, E. O. Rhodes, R. E. Hess, C. L. Warwick, Dean Harvey, J. K. Rittenhouse, W. M. Barr, P. H. Bates, H. J. Ball, T. A. Boyd, J. T. MacKenzie, W. H. Finkeldey, Alexander Foster, J. R. Townsend, L. B. Jones, Sam Tour.

wood will study and develop specifications for this material. The plywood methods are published for information only, but it is anticipated that they may be recommended as tentative during the year. The methods cover the following properties: Compression; static bending; tension; panel shear; plate shear; toughness; hardness; and moisture content and specific gravity.

Rubber Products

Two new tentative standards of important significance in the war emergency were approved as developed by Committee D-11 on Rubber Products, one giving specifications for cellular rubber products formulated by a special committee organized under the Army Ordnance auspices. The material covered is of two types grouped into four classifications including sponge, latex, foam, and expanded rubbers. The various test methods are covered in a previously issued Method of Testing Sponge Rubber Products (D 552) in which a number of revisions were accepted at the meeting.

Because of the inadequacy of the brittleness test which was a part of a standard previously approved, D 736, intensive work has resulted in a new test for stiffening of vulcanized elastomers at low temperatures. Young's modulus in bending is determined at low temperatures and used as a measure of the cold-stiffening characteristics of the material. Provision is made in the method for measuring the stiffening effect produced either by crystallization or by second order transition (vitrification) whichever is involved in the material being tested.

Plastics

Committee D-20 on Plastics continued its very intensive work by offering twelve new tentative standards comprising four important specifications, five test methods, and three recommended practices. Important revisions in twelve other standards were also approved by the Society. The new specifications cover the following: cellulose acetate plastic sheets; ethyl cellulose, methacrylate, and nylon injection molding compounds. They resulted from the program to supply urgently needed standards for use by the Army, Navy, Federal Government, and consumers in general.

The new methods of test are needed to supply new data in the cases of reflection and transmission characteristics, and the stability of chlorine-containing plastics, more accurate data in the case of flexural properties, and standardized procedures in the cases of indentation hardness and specific gravity. The proposed recommended practices have been developed in an attempt to standardize the technique employed in determining the effects produced on plastics by environmental conditions in the cases of effect of heat and accelerated aging. The recommendations on molding impact specimens of general purpose phenolic materials are the first of this type; similar recommendations are needed and are being developed for other materials.

In an interesting discussion on indentation hardness testing of plastics Ladislav Boor pointed out that we are not yet in a position to relate hardness to other properties with any degree of exactness. The test may be used as a quick nondestructive test of identity. It will indicate roughly the compressive (and perhaps tensile) modulus. By the use of the more elaborate analysis, some indication of progressive polymerization in reactive resins may be obtained, and the effect of various fillers and plasticizers may be followed.

Soaps and Other Detergents

To the rather extensive list of its important specifications and tests, Committee D-12 on Soaps and Other Detergents added two new standards at the Annual Meeting, covering specifications for liquid toilet soaps and methods of chemical analysis of industrial metal cleaning compositions. Some of the procedures in the latter cover determination of caustic alkalies, silicates, phosphates, sulfates, nitrates, soaps, rosin, antifoaming agents, organic solvents, etc.

Naval Stores

The intensive work carried on through the year by Committee D-17 on Naval Stores was represented by its extensive report. The widely used Methods of Sampling and Grading Rosin (D 509) have been revised. This standard is important because all rosin sold in interstate commerce must be described by reference to the U. S. standards and is subject to grading. Several items were published for information and comment prior to official action by the Society, including the Proposed Method of Test for Unsaponifiable Matter in Rosin. Several proposed definitions of terms relate to tall oil. Methods of testing this material are included in the report. There are also published information procedures for sampling and testing dipentene and related terpene solvents and pine oils.

Three Honorary Memberships Awarded

Messrs. Hermann von Schrenk, Milton Earl McDonnell, Rudolph Philip Miller Honored

Three members of the Society who have for many years been very active in its technical work, each being an outstanding technologist in his chosen field, were awarded Honorary Membership at the 1944 Annual Meeting in New York, ceremonies taking place at the evening session on June 28. The three members, Messrs. Hermann von Schrenk, Milton Earl McDonnell, and Rudolph Philip Miller, have made many notable contributions to the work of the Society and have won wide recognition for their technical work. Biographical information about the three men, and a few notes about the awards follow.

Hermann von Schrenk

Dr. von Schrenk, a Past-President, was presented to President Dean Harvey by Dr. T. G. Delbridge who referred to his notable accomplishments and also mentioned that at a national political convention on that very same day mention had been made of three important factors—youth, vigor, and wisdom—which also were typified by Dr. von Schrenk, despite his years. As stated by Dr. Delbridge, ". . . a man who is young enough in his ideas at least to be my son, and who is vigorous enough to be my master, and who is wise enough to be my father."

In his response Dr. von Schrenk referred to the fact that happenings are more or less of an accidental nature. . . . "You drift into a field of endeavor, you are pushed, you are animated and inspired by the men whom you know, by the conditions where you get an opportunity to work.

"I have stood before the Society many times in the past and have always given expression to my feelings for

Cut—Courtesy Chemical and Engineering News

Honorary Members—Herman von Schrenk, M. E. McDonnell, R. P. Miller

A.S.T.M. This honor which you have done me tonight comes as another evidence of my faith and my enthusiasm for this great organization. I wish I had the time here to tell you what has been referred to by Dr. Delbridge—the effect which the Association and the numerous members in this Society have had on me, the manner in which it has cultivated my enthusiasm and my feeling of faith and hope in the work which this Society has always stood for.

"I want to pledge you, while accepting this honor, Mr. President, that I hope I may have some years to give, further years, to my faith in the American Society for Testing Materials."

Born in College Point, Long Island, New York, Hermann von Schrenk, Consulting Timber Engineer, St. Louis, Mo., received his Bachelor of Science degree at Cornell University in 1893; Harvard awarded him his Master of Arts in 1894, and in 1898 he received his Ph.D. from Washington University. For a number of years he was an instructor in plant diseases at Shaw School of Botany, Washington University, and was at the same time pathologist in charge at the Bureau of Plant Industry, U. S. Dept. of Agriculture. For four years, 1901 to 1905, he was Special Agent and Chief of the Division of Forest Products, Bureau of Forestry. During the ten years from 1900 to about 1910, he was lecturer on plant pathology and related subjects at a number of schools, including Yale, University of Wisconsin, Biltmore Forestry School, and others.

In 1907 he began his work as consulting timber engineer which extended to include work for many of the country's leading railroad systems. This service has continued down through the years for many of these organizations. During the current war years, Dr. von Schrenk has been very active in connection with problems of procurement and utilization of timber.

Dr. von Schrenk has been interested in many societies and organizations, including the American Railway Engineering Association, where he served as a member of the Board of Directors; American Society of Naturalists, where he was treasurer; Audubon Society of Missouri, St. Louis Garden Club, and the Missouri Forestry Association (president at some time of each), and a member of numerous other groups including the American Society of Civil Engineers, and the American Association for the Advancement of Science. He has written widely, including the books, "Decay of Timber and Methods of Preventing It," "Diseases of Hardwood Trees," and has prepared various papers and articles.

In the Society, of which he has been a member since 1903, he was President 1934–1935, has been Chairman of Committee D-7 on Timber since 1904, the year of its organization (this record of service is unsurpassed in A.S.T.M.). He has also served on Committees C-5 on Fire Tests and Construction and D-1 on Paint, Varnish, Lacquer, and Related Products. He is also Chairman of the St. Louis A.S.T.M. District Committee.

Milton Earl McDonnell

Presented by Past-President G. E. F. Lundell, Dr. McDonnell, who had a few weeks earlier retired from his long-time service with the Pennsylvania Railroad at Altoona where he had been associated with many A.S.T.M. leaders, including Founder-President, Charles B. Dudley, and the incoming president, P. H. Bates, expressed his appreciation and thanks for the honor conferred.

A native of Pennsylvania, Dr. McDonnell, formerly Chief Chemist of the Pennsylvania Railroad, Altoona, has spent his entire industrial life in this state. A graduate of Pennsylvania State College, 1893, with a B.S. degree, receiving his M.S. degree in 1896, he was, for a time, instructor in the Agricultural Experiment Station at Penn State. He later studied abroad, receiving his Ph.D. at the University of Kiel in 1899. Soon after, on November 1, 1899, he began his long-time service with the Pennsylvania Railroad where he was for many years associated with Dr. Charles B. Dudley, first A.S.T.M. President, and Past-President F. O. Clements. He was assistant chemist, later bacteriologist, was appointed assistant chief chemist in 1916, and served as chief chemist from 1921 until his retirement in 1943.

During his service with the railroad, he was concerned with a wide variety of technical problems. He prepared various technical papers, one of the earlier ones with Charles B. Dudley, dealing with the "Disinfection of Passenger Cars," and a later paper covering "Rust-Proofing of Materials," particularly copper bearing steel. Dr. McDonnell has been active in the work of many organizations in the chemical engineering field, including the New York Chemists' Club, the American Chemical Society; he is also a member of the American Association of Railroads, Altoona Engineering Society, and other local groups.

A member of the Society since 1910, he has been active on many A.S.T.M. standing committees, particularly Committees E-3 on Chemical Analysis of Metals, A-1 on Steel, B-2 on Non-Ferrous Metals and Alloys, D-9 on Electrical Insulating Materials, D-1 on Paint, Varnish, Lacquer, and Related Products, and D-11 on Rubber Products, where he was a member of the Advisory Committee. He has also been active in the work of a number of subcommittees of each of the standing committees mentioned above.

Rudolph Philip Miller

Mr. Miller was conducted to the platform by Past-President H. H. Morgan, who discussed some of Mr. Miller's notable accomplishments, particularly in connection with building codes and building construction. Mr. Morgan stated, "Now, with this background of experience in the involved work of building code development, and the advances in construction of this country for almost fifty years, this man has exerted a knowledge, interest and persistence, all with a sympathetic patience that justifies extraordinary comment. For over ten years I have known him personally and for over twenty years I have been familiar with his work. There are just two words synonymous with the feeling of all who have become acquainted with him in that work. Those two words I have already heard mentioned tonight, and I take a good deal of significance in mentioning them again. Those two words are 'esteem' and 'affection'."

In his brief response, Mr. Miller said, "No doubt, those who had the selection of men to be honored in this fashion have had some good reason for it, and while I may have my doubts as to whether they have made a good selection in my case, I cannot but accept it as a very high honor, because outsiders sometimes can judge better of us than we can ourselves."

Identified with buildings and building code development in a prominent way for almost 50 years, Rudolph Philip Miller, Consulting Engineer, New York City, is undoubtedly the dean of building code experts. By 1888, Mr. Miller held degrees from both the College of the City of New York and Columbia University. In 1895 he entered the service of the

New York City Department of Buildings, resigning in 1908 to enter private practice. In 1910 he returned to city service as Superintendent of Buildings for the Borough of Manhattan. During 1914–1915 and part of 1916 he had charge of the revision of the New York building code. In July, 1916, Mr. Miller was appointed chairman of the Board of Standards and Appeals, a newly created body for rendering interpretations of the building laws when disputes arose, and for formulating rules to place the building code in effect in a uniform manner in all boroughs of the City.

After serving for a short period with the U. S. Housing Corp., Mr. Miller returned to private practice after the war, and in 1920 was appointed Superintendent of Buildings for the Borough of Manhattan for the second time, serving two years in that capacity. At present he is engaged in private practice, his work being chiefly in the preparation of building codes and zoning ordinances for various municipalities, serving as consultant in the introduction of new materials and forms of construction, investigating building failures, making reports on existing buildings, etc.

A member of the Society since July, 1903, he has been an officer, from the year of inception of Committee C-5 on Fire Tests and Materials of Construction, first as Secretary, and since 1928 as Chairman. Other technical committees on which he has served include C-11 on Gypsum and the former Committee C-10 on Hollow Masonry Building Units. He represents the Society on the A.S.A. Building Code Correlating Committee, and is Chairman of the Sectional Committee on Specifications and Fire Tests of Materials and Construction, A.S.A. Project A-2.

Mr. Miller has been active during his professional career in various technical organizations. He was president of the National Fire Protection Association for two years; president of the Building Officials' Conference for the first ten years of its existence; vice-president of the American Institute of Consulting Engineers for one year.

In addition to A.S.T.M., he is a member of the American Society of Civil Engineers, besides holding membership in other nontechnical organizations.

Certificates Awarded Forty-Year Members

CONTINUING the practice of awarding special certificates to members who have been continuously affiliated with the Society for four decades, eight personal members and five organizations were recognized at the general session of the 1944 Annual Meeting on June 28, as follows:

W. F. Angus
Robert A. Cummings
Dominion Bridge Co., Ltd.:
A. S. Wall
William R. Dunn
Froehling & Robertson, Inc.:
Grant J. Durant
Illinois Central Railroad Co.:
C. R. McEwen
C. S. Reeve
Alfred E. Roberts
Herbert L. Sherman
Frank N. Speller
Sanford E. Thompson
Tufts College Engineering School:
F. N. Weaver
Westinghouse Electric and Manufacturing Co:
Dean Harvey

With each succeeding year more and more members will be recognized, because the Society experienced a steady increase in growth from 1904 and 1905 on.

Post-War Standardization[1]

By J. B. Carswell[2]

MY WAR JOB IN the United States during the past four years, has brought me into very close contact with the Conservation Bureau of the War Production Board in Washington, and with similar activities in the Department of Munitions and Supply in Ottawa. These movements were, and still are, almost violent in their intensity. They were conceived in the atmosphere of acute material and man-power shortages, and nurtured in the enthusiasm toward the war effort. The results achieved in the few short war years have been truly remarkable.

While I shall not present any extensive statistics, my colleagues tell me that this branch of the War Production Board has saved the efforts of $5^1/_2$ million workers, and avoided the necessity of building, in the United States alone, an additional Steel capacity of 5 million tons per annum.

Most startling figures I admit, and at first glance, one might be inclined to throw one's hat in the air and shout "Three cheers for the Engineer, for Standardization and Simplification." But is that the real answer? Might we not equally logically say "Shame on the Engineer for allowing such an amount of dry-rot to accumulate in the twenty-five years between these wars, in these fields of Standardization and Simplified Practice."

I think the latter reaction is the proper one. I am old enough to remember very distinctly the shock and the purging which engineering and manufacturing got in the last war, both here in Canada, and particularly in the United States, under the guidance of our good friend Shaw of Chicago.

And now it takes another war to purge us clean again. Instead of waving the flag about the number of workers we have saved, should we not hang our heads in shame, when we think of the millions and millions of man-hours that have been dissipated to the four winds in the past

Standardization **is distinctly a creative job. It might be defined as the art of determining, and establishing in use, the best design, quality, or method of process for performing a desired function.**

Simplified practice **on the other hand, is an eliminating job. The job of dealing, as someone said, in tremendous trifles. It could be defined as the method of eliminating superfluous variety through the voluntary action of an industrial or commercial group.**

By pursuing these two movements, we arrive at *Interchangeability,* which results in conservation of materials and manpower, or negatively to the elimination of waste. The sum total spells out to *Progress.*

[1] Presented at a meeting in Toronto, May 9, 1944, sponsored by the Affiliated Engineering and Allied Societies in Ontario. An extensive news account of this meeting in which A.S.T.M. Secretary-Treasurer, C. L. Warwick and C.S.A. Secretary, Col. W. R. McCaffrey participated, was published in the May ASTM BULLETIN, No. 128.

[2] OBE, President, War Assets Corp., Ltd.

two decades. Why? Because we allowed, in great measure, the ever-present problems of Standardization and Simplification to be shoved to one side by apathy, ignorance, and distorted selfishness.

So, we address ourselves to this problem as it will affect the post-war world, which we all hope and pray is just around the corner.

First, let us get our definitions clearly established, because, even an amateur like myself cannot fail to notice a prevalent confusion between the two main branches of our subject.

Standardization is distinctly a creative job. It might be defined as the art of determining, and establishing in use, the best design, quality, method or process, for performing a desired function.

Simplified practice on the other hand, is an eliminating job. The job of dealing, as someone said, in tremendous trifles. It could be defined as the method of eliminating superfluous variety through the voluntary action of an industrial or commercial group.

By pursuing these two movements, we arrive at Interchangeability, which results in conservation of materials and manpower, or negatively to the elimination of waste. The sum total spells out to Progress.

Next, let us find out what forces are with us and what forces are against us, as we strive after the goals of universal standardization and complete simplification in practice. Undoubtedly, there are many extraneous forces, both complex and powerful. It would be quite unfair to suggest that the slowness of our progress has been entirely due to the apathy and inefficiency of the engineer and the industrialist.

We are faced with four great enemies. The first is Ignorance; the second is Fear; the third is Selfishness; and the fourth is one for which I personally, have a kind of sneaking regard. It is hard to give him a name. The best I can think of, is Individuality.

On the other hand, we have fighting for us, three great allies. The first is Common Sense; the second is Economy; and the third is that intangible thing, which, again for the lack of a better name, I call Universal Brotherhood.

We need not spend much time in analyzing our friendly allies. Everyone knows that universal standards and complete simplicity of practice are only common sense, and that the results would mean maximum economy in industry. And we all should know that if we ever reached that Fabian state of universal brotherhood, nothing but our own stupidity could prevent our reaching our goals in short order.

But what about our enemies? They must be sized up very carefully.

The first one—Ignorance. Well! he is not so formidable. We are wearing him down right now. We have been wearing him down, for years back, by ordinary hard work. He is not an aggressive type of enemy. He is merely an obstruction that has to be whittled away to make room for progress.

The second enemy—Fear—is much more dangerous. It takes just such a war as the present one to bring into sharp focus the extent to which Fear, in the past, has blocked the progress of universal standardization.

Now, you may say to me that everyone knows that the military authorities will not, at any price, have universal standardization, and that, for the time being, we must accept that. That was fine during the past century. It was not even serious up to World War I. We could simply by-pass these stupidly conservative military fellows and apply our efforts to the great civilian field. But today, when mechanized warfare has enlisted the complete field of engineering science, the situation becomes really serious.

Who can say today whether a ship, or an airplane, or a truck is a vehicle of war or a vehicle of peace? The line of demarcation has disappeared, and military fears are steadily encroaching on what used to be our purely civilian territory. We cannot by-pass this enemy any more, for he will attack us on the flank. He has to be reckoned with. I firmly believe that in the next few years, the progress of standardization must face this new problem with all the courage and energy at its command.

Surely, we could fight for an acceptance of common standards amongst the English-speaking nations of the world, leaving the universal problem to our children and our grandchildren. Is it not a frightful commentary on the common sense of the people on this North American continent that, when this war broke out, there was not a single gun or a single round of ammunition common to the U. S. and the Canadian forces. We made, and still make, 0.303 cartridges. The U. S. made, and still makes, 0.30 cartridges. How in all the earth do we reconcile these miserable three one-thousandths of an inch, and all the implications that follow in the wake, with our joint glowing tributes to the undefended frontier and the hundred years of peace and fellowship?

Canada, with the rest of the world, is about to establish an international air policy. If there is one great and growing industry in this world, shouting for the need of universal standardization, surely it is the aircraft industry. The airplane of tomorrow will be serviced in Moscow on Monday, in Berlin on Tuesday, in Lisbon on Wednesday, and in Toronto on Thursday; but will the aeronautical engineer be given a free hand, or will the giant Fear whisper successfully in the ears of governments, "Look out now, these planes are carrying goods and passengers today, but it may be bombs and guns tomorrow?"

Only a few weeks ago, quite a lot of people lost their lives in a small but boisterous South American Republic, when some civilian planes were sent up in the air to drop explosives in aid of a revolting political party. These planes had been given to the republic by a friendly neighbor to assist in the peaceful pursuits of industry.

So you see, we are far from discussing a purely academic theory. In fact, phases of this problem are on my desk right now in connection with this new job which the Government has seen fit to give me.

But let us pass on to the third enemy, Selfishness. He is the brother of Fear. They work as a team.

I wonder how many of us realize that on September 3, 1939 (or if our American friends please, December 7, 1941), two things happened. A war was declared, and an armistice was signed on the same day. Up until these dates,

Let us always remember that standardization is a service to current production, and never a brake on progress.

talking both domestically and internationally, we had been fighting, sometimes quite bitterly, to destroy each other's operating accounts. We called a halt on this gentlemanly war, and decided to go after the capital assets instead.

Now, when this war to destroy capital is over, the other war, naturally, will start again, and once more we will be engaged on the interminable job of trying to steal an unwarranted proportion of the other fellow's business. And then it is, when selfishness comes in for his innings. He whispers to the British industrialist, "Be careful now, if you start adopting universal standards, you will jeopardize your foreign trade which is tied up now with your peculiar trade practices." Our friend and ally, common sense, may be whispering in the other ear "But don't you see, it will widen your market and everyone's market."

Let's leave them whispering. Personally, I am a little pessimistic on the outcome. We travel on to the last enemy—that rather likeable fellow, individuality.

He can be dealt with, if you recognize clearly his dual personality. His only argument is, that you and I and every free-born citizen, demand that we continue free to express our egos in the way we desire; that we do not want to be standardized, that standardization and regimentation are almost synonymous. He will ask you what you are fighting for. He will quote you the Four Freedoms. In fact, he will try to get you all confused.

The answer is quite clear. No one wants to see material production in this world so standardized that we cannot tell whether we are walking down Fifth Ave., New York, or the Champs Elysees in Paris. The aesthetic things in life will never be standardized, but in the utilitarian things behind the scenes, what a field there is for progress; what a field for elimination of waste and useless duplication!

And so I have tried to paint a little picture of the international aspects of our problem as we approach the postwar. At first glance, it may appear to be a somewhat gloomy picture, but I do not intend it as such. What I really submit to you is the thought that before we sow our seeds of endeavor, we make sure that we are not sowing them amongst the tares and thistles. We have so many fertile fields in which to work; there is so much work to do, that it would be futile indeed, to waste a serious portion of our energies on the untilled soil.

Standardization, like charity, really begins at home. When we think of our problem in national terms instead of international, how much simpler it all becomes. Today, at least on this continent, the educational battle has been won. We all accept the movement toward standardization and simplified practice as an imperative phase of industrial progress. I can well remember when the Canadian Engineering Standards Association was formed in Canada and we all forked out our first contributions—more because Jimmy Morrow said so than because we really believed in the new idea. These days, thank goodness, are gone, and I think a word of thanks is long overdue from Canadian industry to the many individuals who nursed the child into healthy manhood.

And I would compliment these men, too, on their wisdom in keeping this whole movement on a voluntary basis. I rather shrug my shoulders when I see government bodies taking standards, setup on a voluntary basis for industry to follow or not, as they see fit, and making them mandatory in government contracts. It may be necessary and in the public interest. I do not know. Personally, I do not like it. Rather would I stick to the old adage, that "Example is better than precept."

In the cooperation between such countries as the United States, the United Kingdom, and Canada, the same voluntary atmosphere should be maintained. I like that phrase which appears on many C.E.S.A. specifications, that they are in "substantial agreement with" numbers so-and-so of A.S.T.M. It indicates that two sovereign nations have achieved complete cooperation without any suggestion of dictation.

When this war is over, the work of C.E.S.A. in Canada, of British Standards Institution in Great Britain, and of the American Standards Association in the States, I would predict, is going to increase many fold. Not only has the war shown up a thousand wasteful practices in which we were indulging, but it has done something else. It has brought into being a flood of completely new industries.

Here is a heaven-sent opportunity to train the child in the way it should go. Here are industries without any tradition at all. I often think that if I were engaged in standardization work, I would shudder when I went in to tackle a firm whose notepaper read "Established in 1867."

Here we have a chance to start at the very beginning. Radar, plastics, advanced aeronautics, and many others, in all their ramifications, must be taught to walk in the paths of standardization and simplicity. These children are growing very fast. Let us look out that we do not delay the start too long.

I know nothing about radar, so I can speak quite freely, but in the past year or two in Washington, my office had to purchase vacuum tubes and valves for radar work. Some of this work was so secret that only one to two men were allowed to know the details. However, I was still permitted to count, and out of my abysmal ignorance, I will say, that if the radar industry, in this year of Grace 1944, being only a few years old, really needs all the multiplicity and variety of tubes and valves that are being made for it, then I'll eat my hat!! My impression is, that already this industry needs the professional help of the standards authorities. Many of you gentlemen have suffered financially, as I have, from this new professional man in our midst, known as the orthodontist. He is the fellow who straightens the childrens' teeth. He works slowly and painfully, but over the years he is worth his hire, for he gets grand results. These new industries, I am afraid, are even now developing overlapping and buck teeth, so there is no time to lose.

In closing, let me add just one word of warning to those engaged in the work of standardization. We should never allow this work to clash in any way with the rapid strides of obsolescence, which have been so marked on this continent since the turn of the century. There may arise situations where the work of standardization has barely been completed, when the product involved is swept aside by the march of invention and ingenuity. Let it be swept aside! So only, can we maintain a healthy stimulated economy. Let us always remember that standardization is a service to current production, and never a brake on progress.

Minerals in War and Peace[1]

Address by C. K. Leith[2]

I SHALL TALK about minerals not as museum specimens but as vital raw materials for industry and for armament and as controversial international problems. The industrial use of minerals began with the industrial revolution, but when we realize that the world has used more minerals in the last three or four decades than in all preceding history, we can see that the problems involved are really new in human affairs.

The world mineral supply question was brought acutely to public attention at the time of the first World War, when Germany cited the need of minerals as an important reason for her aggression. At the close of the war the important mineral centers of the Ruhr, the Saar, Lorraine and Silesia figured prominently, as you will remember, in the peace settlement as part of the program to prevent rearmament. The following two decades witnessed a world-wide scramble for mineral supplies on the part of many nations. Governments began to participate. A wave of nationalism swept over the world at this time which resulted in the closing of the doors of many countries to mineral exploitation by foreigners, while intensified efforts were made to develop resources at home. An extreme case is Russia. Before the present war, raw materials were announced as objects of the aggression of Germany in southeastern Europe, of Italy in North Africa, and of Japan in eastern Asia, and early in the war these objectives were, in the main, achieved. It is now generally recognized that the winning of the war will depend largely on the weight of metal thrown into the scale to produce armament on land, air, and water. If time permitted, I would like to tell you the story of the United Nations' war effort in minerals, but I will say only that the effort has been highly successful, and that, through our control of the sea, the United Nations are now in a position to throw such an overwhelming weight of metal into the scale that the outcome seems fully assured. The consumption of minerals in the United States in the present war has surpassed the last war to an extent that no one would have dared predict. For instance, our use of magnesium in this war has multiplied 1400 times; of aluminum, 20 times; of chromium, 7 times; of copper, 5 times; of petroleum, 4 times; of steel, twice.

The job of mineral procurement for the war is now pretty well done. Minerals are now available to produce armament on a winning scale, whether the war be short or long. In fact, at this moment we are confronted with an actual or potential surplus of some of our minerals. It is not easy to check the impetus of production now under way. Prospectors and miners are so grooved to the finding and exploitation of minerals that they are not mentally geared to reverse the process.

Under these circumstances it is not surprising that attention is now turning more and more to postwar plans for minerals, to see what can be done not only about postwar surpluses of production and stocks, but about acquiring access to supplies abroad necessary both for our future growing industry and for our future defense. In a larger sense we face the problems of adjusting our national self-interest to that of other nations, without increasing the danger to world peace inherent in the competition for supplies among the nations. This competition reached the explosive stage before the war and is sure to explode again unless something is done about it. Neither the United States nor the world can afford the appalling waste of minerals in another world war. The United Nations at the close of the war presumably will have overwhelming political and commercial control of the world's minerals, supplemented by control of the sea over which they must move. The wisdom with which this control is exercised will play a vital role in the maintenance of peace.

What, then, should be the foreign mineral policy of the United States, and how shall this policy be implemented?

I shall not attempt to present a blueprint of future mineral policy. I doubt whether an adequate blueprint is yet in existence, but I will sketch certain elements which should be considered. In other words, I will state the problem.

STATEMENT OF THE PROBLEM

First, we must recognize the fact that no nation in the world has enough of all the minerals—not even our own, which is better endowed than any other nation. Our dependence on foreign sources of supply has steadily grown, and will continue to grow, because of the huge demands of modern industry, augmented by the demands of war and the consequent depletion of our own reserves. Supplies that have seemed ample in the past now look much smaller. Also advances in technology are increasing our dependence on foreign sources. In the present war, for instance, there are more than 30 minerals on the "required" list which were used little or not at all in the last war. Many of these minerals are available only in foreign countries.

Interdependence of nations in regard to minerals is not a mere matter of commercial convenience, it is an inescapable fact of mineral distribution. Nature has fixed the position and quantity of minerals for once and for all, and this fact cannot be changed by enactment.

In recognition of this, the Atlantic Charter calls for

> "access, on equal terms, to the trade and to the raw materials of the world which are needed for . . . economic prosperity."

It is not enough merely to announce the principle of equal access to raw materials. The program must be worked out, and here we run into difficulties, any one of which may well defeat the program. Let me review briefly some of them.

In general, it may be said that adequate mineral supplies have been available in peacetime to all nations and industries with very few exceptions, but not at equal cost, and that the demand for equality of access is based in considerable part on equality of cost and the desire to control

[1] Presented at the Forty-seventh Annual Meeting, Am. Soc. Testing Mats., New York, N. Y., June 26–30, 1944.

[2] Mineral Consultant, War Production Board, Washington, D. C.

resources politically in order to lower costs and to insure access for war purposes. Another cause for complaint is inequality of purchasing power. It is clear that no program can guarantee full equality of access at equal cost because of the geographic and transportation factors involved, or that it can guarantee equality of purchasing power.

The lowering of trade barriers has become almost synonymous in the public mind with the attainment of equality of access to raw materials. In a broad sense, trade barriers include nearly all of the measures, public and private, affecting the international flow of minerals, but the term is ordinarily used in a narrower sense to include import and export tariffs, supplemented by quotas, embargoes, licensing arrangements, trade agreements, and exchange controls. The mere mention of these measures should be enough to bring to your mind the kinds of difficulties which will be encountered in our attempt to remove them. Probably none of them have been adopted for the purpose of hurting other nations, and particularly for the purpose of discriminating against the so-called "have-not" nations. In every case the purpose from the national standpoint has been either that of fostering domestic industry and improving standards of living, or preparing the nation for war. These are understandable objectives. The actual results in many cases have been high prices, excessive profits, overproduction, uneconomic and anti-conservational developments, and the diversion of the international flow of minerals from the cheapest world sources. In the aggregate, they have been prolific sources of friction. Much can be done in the way of revising trade barriers and eliminating abuses, but it seems very unlikely that barriers could or should be eliminated entirely, and that even if they were, it would not completely solve the problem of equal access to world resources. After we have done our best, United States nationals will probably encounter many obstacles in their effort to secure mineral supplies from abroad on the ever-increasing scale necessary to supplement our dwindling reserves. They will be in competition not only with foreign industry but with foreign governments which already are deeply involved in mineral control. They will be up against planned economies of many nations. Should our nationals be allowed to compete on their own, or should the Government help? What form should this help take? Should it be merely diplomatic? Should it include participation through direct ownership or subsidies? The call for public aid of one kind or another has already become very insistent even on the part of those clamoring for complete freedom of trade.

Mineral Sanctions:

Now let us turn to another important element in the mineral program. The Atlantic Charter, in effect, makes an exception to the principle of equality of access when it promises only the raw materials necessary for economic prosperity and stresses the necessity of disarmament of the Axis nations. Disarmament requires some measure of control of the raw materials necessary to make armaments.

Marshall Smuts in 1927 coined the name "mineral sanctions" for the procedure of controlling raw materials to prevent rearmament. Article 16 of the League of Nations authorizes sanctions, but when the League tried to impose them on Italy on her invasion of Ethiopia, they failed—not necessarily because the idea was wrong, but because it was so poorly planned and executed.

Raw material sanctions, while simple and understandable in purpose, involve many complications which must be thought out well in advance. Shall raw materials be controlled at the source, through control of imports, through control of consuming plants, or by some combination of these measures? Should control be exercised only for the part of the material known to be headed for armaments or should it include parts which could be diverted overnight to armament? How shall exports from small or neutral countries to Axis nations be controlled by the powers enforcing the sanction? What kind of administrative machinery should be set up? Should this machinery be entirely governmental or should it include industry? Should it utilize the knowledge and experience of cartels?

As serious as these sanction problems are, some way must be found to solve them if we really mean what we say about preventing the rearmament of the Axis powers.

Stockpiles of Minerals:

Another national mineral problem which is now receiving more public attention in Congress and elsewhere than any other is the acquirement of stockpiles of minerals which are deficient in the United States, for protection against future emergency. This is much involved with the question of freezing surplus stocks which (together with huge supplies of war scrap) will demoralize the industry if dumped on the market.

As a result of the trying experience of World War I, Mr. Baruch, in his report of 1919 to the President, urged that steps be taken at once to insure adequate supplies of raw materials for future emergency. In the twenty years that followed, the same program was urged on Congress by many individuals and agencies, public and private, including the Secretaries of War and Navy, many members of Congress, and others. However, nothing was done about it until 1939 and then the purchase of stockpiles was started much too late and on a scale much too small for the present emergency. While the problem of acquiring supplies of strategic minerals has now been solved for the present war, the delays and difficulties have been so great that the Government is again considering plans for the acquisition of stockpiles for future emergencies. The principle of stockpiles now seems to have found wide acceptance, but again the formulation of a program raises difficult questions. What scale of emergency shall be prepared for? In other words, how big and long might be another war? What minerals shall be included in view of the changing requirements of modern industry? Shall raw materials be acquired for stockpiles in repayment of Lend-Lease? Shall these stockpiles be under control of the military or the civilian agencies? Shall stockpiles be built up in part from domestic sources, particularly from small and marginal enterprises requiring public subsidy? Strong differences of opinion have developed about every one of these questions, but it is to be hoped that the necessary legislation to secure a stockpile may be enacted while the need is fresh in mind, in order to avoid the possibility that it may be forgotten if we again become too complacent about our national security.

Commercial Control:

I have discussed only a few of the problems involved in a national mineral policy, but time will permit me to men-

tion only one other. Nature's concentration of minerals in a few large sources has favored the evolution of large commercial units of control, such units as large corporations, trusts, cartels, and even monopolies. As the industrial demands for minerals have grown, they have become more and more focused on the few large sources of supply capable of meeting these demands efficiently and cheaply, and capable of handling the large-scale problems of production, equipment, technological research, transportation, and marketing involved. The inevitable result has been "big business." Under these circumstances, small and marginal producers have contributed less and less to the total supply. In some cases this concentration of power has been abused and it is natural that anti-trust and anti-monopoly sentiment has grown more or less in proportion to concentration of power.

In spite of abuses, the evolution toward large units of control is backed by such compelling reasons of efficiency and conservation that I doubt whether it will be permanently stopped or reversed, but it certainly is being retarded by anti-trust sentiment, making it hazardous to predict the immediate future of these forms of control. In this case, the Government is ostensibly out for free enterprise in opposition to controls of industry, and industry is itself divided as to the merits of these controls depending largely on whether it is in or outside of the controlling unit. This is a highly controversial subject, but I venture the opinion that a wise policy should not be directed toward setting the clock back, but toward the improvement of big business controls through measures which will compromise the profit motive with consumer and public interest.

Supplementary Comments:

Up to this point my statement of the mineral problem has been very much generalized and simplified in the hope of making it understandable, and it may even sound dogmatic. I would like now to tie it in a little more closely with the factual background in anticipation of some of the questions which my statement may have raised in your minds.

I have spoken of the predominance of mineral control by the United Nations. In 1939, the U. S. nationals controlled politically 34 per cent of the world's mineral production (by value), and controlled commercially another 10 per cent in other countries. The British Empire controlled politically 23 per cent and another 5 per cent or more in other countries. Russia and China accounted for 13 per cent. The total political and commercial control of the United Nations was about 85 per cent. Germany and Japan between them accounted for only 12 per cent.

Will this predominance of United Nations control be upset by discovery? Probably no. The world is becoming pretty well known, the rate of discovery is definitely falling, and the chances are that in the future, as in the past, the United Nations will make most of the discoveries.

Depletion of our mineral reserves is becoming serious from the long-range point of view, requiring conservation, though shortages are not immediate.

It has been predicted that technological advances and substitutions will lessen dependence on mineral supplies. The record to date does not bear this out. Production of all minerals has grown steadily in spite of many spectacular technologic changes.

Will sanctions stick? Judging by our course following the last war, the chances are that they will not. We are likely to become softhearted in a few years. About the best we can hope for is that controls may continue longer than before, because the lessons of the last war are still fresh in memory and because of the growing public recognition of the part of minerals in war.

The mining industry stands generally for free enterprise as against public controls, but a review of twenty-five kinds of past controls indicates that most of them have been invited by the mining industry itself. The trend toward coordination and control, public and private, seems to have been an inevitable consequence of growing size and growing public interest.

Conclusions

In conclusion, questions of American mineral policy of the kind I have outlined are all being studied now by various government and trade groups, and sound answers to some of the questions seem to be in the making, but no one has yet formulated an American policy which coordinates all of the pertinent factors. Up to the present we have had only piecemeal, partisan and intermittent attempts to formulate a mineral policy. It will not be an easy job. Narrow self-interest, both commercial and national, will be encountered at every turn. Any restriction of production, or export, or access to foreign supplies, or intervention of Government in any phase of mineral trade will be vigorously opposed by advocates of free private enterprise. Purely domestic considerations are likely to outweigh the advantages that might be obtained from international cooperation. The requirements of the immediate present will tend to dwarf longer-range considerations. The striking of a proper balance between cooperative control and free enterprise will require statesmanship of a high order.

Book on Welded Steel Structures

The American Welding Society, 29 West 39th St., New York, N. Y., has just issued in book form a very extensive technical paper published in its September, 1943, *Welding Journal* covering "Practical Design of Welded Steel Structures" by H. Malcolm Priest, but the book also includes other material by the author covering engineer essentials for welders. The October ASTM Bulletin cited this paper as an outstanding one, concisely written, splendidly illustrated, and of interest not only from the general standpoint, but also to the welding specialist. Copies of the book of 153 pages, page size $5^1/_8$ by $7^3/_4$ in., can be obtained at $1.00 each.

British Book on Plastics

Recently received from Temple Press, Ltd., Bowling Green Lane, London, E.C.1, publishers of the British Magazine *Plastics*, is the first edition of a new technical volume entitled "Plastics, Scientific and Technological," by H. Ronald Fleck. In some 325 pages (80 illustrations), the author has included information that will doubtless be of interest to many technologists in this field. Chapter headings give some idea of sequence of the material. Beginning with History and Raw Materials, the headings continue with Polymerization, Chemistry, Manufacture, Synthetic Elastomers, Physical Properties of Thermo-plastic and Thermo-setting, Synthetic Resins, Fibres and Textiles, Adhesives, Plywood, etc., Dies and Moulds, Plastic Articles, Chemical, Physical and Electrical Testing, and Chemical Analysis.

Copies of this book can be obtained from the publishers at 25s-net.

Corrosion Testing of Water-Soluble Aluminum Cleaners

By Jay C. Harris[1]

THERE ARE available many excellent reference books which deal exclusively with corrosion in its multitudinous aspects. However, it cannot be said that this field is closed, because new problems are posed by the availability of new alloys, changes in chemical technology, the production of new chemicals, and the present need for finding suitable substitutes because of materials shortages. It is recognized that corrosion testing is a highly controversial subject, probably because of the many possible conditions to which materials may be exposed or under which they may be used. Properly enough, therefore, corrosion testing has as generally as possible been conducted under practical conditions of usage. It is also assumed that any accelerated test should be reproduced under conditions which can be closely controlled. Consequently, initial tests are best carried out in the laboratory under closely defined conditions where control of all factors is possible. At first glance the problem seems simple and there appear to be no interfering factors, and all that should be necessary to the test would be exposure for a given period of time under a chosen set of temperature and concentration conditions. Unfortunately, there are a number of important factors which are thus entirely overlooked, and consideration will be given them later in this discussion.

As previously mentioned, corrosion testing is, as generally as possible, made under practical conditions which are atmospheric, seashore or sea-water immersion, acid or alkaline conditions. Much has been written on these tests, but the importance of corrosion testing under alkaline conditions is less well standardized, especially as most metals and alloys are fairly resistant to alkalies. The outstanding exception to this is aluminum and its alloys. As will be indicated, there is no standardized procedure for the corrosion testing of aluminum, so that this offered a field for standardization which could prove of benefit to industry.

Literature Survey

A literature search (*1*)[2] indicated the considerable volume of work on the corrosion testing of aluminum, but showed no uniformity in the procedure for making such tests. An attempt has therefore been made to outline the essential characteristics of a number of the corrosion tests which have been published. While these tests have in general been used only in testing the corrosiveness of cleaning agents against aluminum, the general outline should likewise be useful when applied to other metals. For purposes of comparison and examination, the corrosion test may arbitrarily be divided into four phases, namely:

Apparatus (required for making the test),
Metal preparation,
Method of test, and
Expression of results.

It is of interest to attempt to apply this outline form to available references on the subject of corrosion of aluminum by cleaning agents. Inspection will indicate the lack of testing uniformity, which may be attributed to the use of performance tests under certain specific practical conditions. The work of a number of investigators is discussed below.

Hunziker, Cordes, and Nissen

Hunziker, Cordes, and Nissen (2) used the following technique in testing washing powders:

Method:

Partially immersed strips in solutions of materials under test in closed Mason jars for 5 hr. at 150 F. for alkalies, and 5 days at 70 F. for chemical sterilizers. Used 0.5 per cent solutions of alkalies.

Mitchell

Mitchell (3) used the following method for testing aluminum cleaners:

Apparatus:

1. Calibrated 6-in. test tubes.
2. Beaker of suitable size.

Metal Preparation:

1. *Size Panel (or Strip).*—1/4 by 2 in.
2. *Precleaning.*—Clean with benzene or ether, and wipe dry.

Method:

1. Accurately weigh strip.
2. Insert strip in calibrated test tube filled with cleaning solution of given concentration and inverted in beaker.
3. Place beakers in a water or steam bath for 15 min.
4. At end of 15-min. period record volume of gas evolved, remove strip, rinse in standard manner, and reweigh.

Baker

Baker (*4*) tested tin plate, aluminum, zinc, and tin under the following conditions:

Apparatus:

1. Bottles.
2. Constant temperature oven.

Metal Preparation:

1. *Size Strip.*—3/4 by 2 1/2 in.
2. *Precleaning.*—Not indicated.

Method:

1. Clean and accurately weigh strips.
2. Insert strips in tightly stoppered glass bottles containing 100 ml. of cleaning solution.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] Chairman, Section G on Metal Cleaners, Subcommittee II on Specifications, Committee D-12 on Soaps and Other Detergents; Monsanto Chemical Co., Dayton, Ohio.

[2] The italic numbers in parentheses refer to the reports and papers appearing in the list of references appended to this paper.

3. Place bottles in oven at 60 ± 2 C.
4. Period of exposure is 8 to 24 hr.
5. Remove strips, wash thoroughly in distilled water and then in alcohol, dry, and weigh.
6. Time - concentration curves over 8 to 24 hr. and from 0.005 to 10.0 per cent concentration of cleaner are determined.

NOTE.—Some strips carried incrustation so that weight losses did not always represent total metal loss.

Thomas

Thomas (5) tested dishwashing compounds under the following conditions:

Metal Preparation:

1. *Metals.*—Used three brands of aluminum kitchen utensils.
2. *Precleaning.*—Etch 2 min. in aqueous 10 per cent sodium hydroxide solution.

Method and Expression of Results:

Totally immerse panels in aqueous 0.5 per cent solutions at 60 ± 2 C. for 60 min. Ratio of area of exposed metal to the volume of test solution was generally 2 sq. dm. per l. Loss in weight was determined.

General Chemical Co.

Canadian patent No. 411,280, issued to General Chemical Co. (6), utilized the following test in the evaluation of aluminum cleaners:

Metal Preparation:

1. *Size Strip.*—Strips of equal size.
2. *Precleaning.*—Not indicated.

Method and Expression of Results:

1. Weigh strips.
2. Immerse in cleaner solution at 150 F. for $^1/_2$ hr in solutions of 0.10, 0.15, 0.20, 0.25, 0.30, 0.35, 0.40, 0.50, 1.00, and 5.00 per cent by weight.
3. Remove, weigh, and calculate loss of weight as milligrams per square inch per half hour at 150 F.

Mears and Eldredge

Mears and Eldredge (7) tested inhibitors to be used in preventing corrosion of aluminum equipment, utilizing the following procedure:

Metal Preparation:

1. *Size Strip.*—0.064 by 1 by 4 in.
2. *Precleaning.*—Not given.
3. *Metals.*—Aluminum 2S or 3S-$^1/_2$H.

NOTE.—The nominal composition of 2S is 99.0 to 99.4 per cent Al; 0.6 to 1.0 per cent Fe + Si + Cu. That of 3S-$^1/_2$H is 1.2 per cent manganese, balance aluminum.

Method:

1. Partially immerse specimens in solution being tested.
2. If weight losses were significant, the percentage protection using inhibitors was calculated. If corrosion was localized, the visual appearance and depth of attack were microscopically measured. If corrosion was localized the visual appearance was more important than weight loss and was relied upon for rating the inhibitor.

Mears

Mears (8) describes two suggested methods for corrosion testing cleaners:

Test A—For Cleaners for Aluminum Aircraft Materials (Nonabrasive for Aqueous Solution).

Apparatus:

1. Glass rod.
2. Beakers.
3. Unidirectional air current from an electric fan.

Metals Preparation:

1. *Metals.*—Chromic acid anodically coated 24S-T, bare 24S-T, Alclad 24S-T.
2. *Size Strips.*—0.064 by 2 by 5 in.
3. *Number of Strips.*—Duplicate.
4. *Cleaning.*—Strips vapor degreased prior to test.

Method:

1. Partially immerse samples in the following concentrations of cleaners in synthetic hard water (10 grains per gallon at room temperature):

   (*a*) Cleaner concentration one fourth the recommended value,
   (*b*) Cleaner concentration one half the recommended value,
   (*c*) Cleaner concentration equal the recommended value,
   (*d*) Cleaner concentration twice the recommended value, and
   (*e*) Cleaner concentration four times the recommended value.

2. Immerse 200 times in the above solutions according to the following procedure:

(*a*) Arrange as many of the specimens as can be conveniently handled on a glass or aluminum rod, with an inert, insulating spacer between the successive specimens. Arrange the series of rods supporting the specimens in a consecutive order to avoid disturbing the order of immersion of the specimens into the cleaning solutions.

(*b*) Arrange the cleaning solutions in a definite order so that each set of specimens is always returned to the same solution.

(*c*) Immerse each set of specimens in the cleaning solutions (do not hold there) and place in a definite order on a rack.

(*d*) Dry for 5 min. in a unidirectional current from an electric fan.

(*e*) After drying, rinse the set of specimens, first immersed in the cleaning solutions and placed on the drying rack, with running tap water; rinse the remaining sets in consecutive order.

(*f*) Allow the excess water to drain from the specimens and again immerse them in the cleaning solutions in the same order followed during the first immersion.

(*g*) Continue the procedure described above until each set of specimens has been immersed 200 times. It is essential that each row of specimens be rotated in order that all specimens will have the same relative position in the air current from the fan for about the same period of time.

Results:

At the conclusion of the test there should be no visible evidence of dulling, staining, etching, or pitting of the

aluminum specimens. If a visible film or deposit is formed on the specimens, the cleaner shall be considered unsatisfactory.

Test B—For Cleaners to be Used in Aqueous Solution.

Metal Preparation;

1. *Metals.*—Bright finished uncoated 3S sheet, and 3S sheet with Alumilite No. 204 coating.
2. *Size of Strips.*—3 by 0.75 by 0.064 in.
3. *Number of Strips.*—Duplicate.
4. *Cleaning.*—Strips vapor degreased prior to test.

Method of Test:

1. Expose for 5 hr. at 80 C. to each of the following concentrations of cleaner: 0.25, 0.5, 0.75, 1, 1.5, 2, 3, 5, 10, and 20 per cent. For each specimen 50 ml. of solution should be used.
2. Some of the undiluted cleaner is placed on other bare and Alumilite-coated specimens which are stored in an atmosphere saturated with water vapor at 25 C. for 24 hr.
3. Bare and Alumilite-coated specimens are cleaned 20 times following precisely the instructions furnished with the cleaner.

Expression of Results:

If none of the specimens in the test method are discolored, etched, or pitted, the cleaner is classified as "safe."

Corrosion Tests Defined by Government Specifications

Corrosion tests defined in various government specifications are presented, as follows:

Federal Specification for Detergents, Special; (For Aluminumware, Dishwashing Machines, and Manual Cleaning) P-D-236 November 18, 1941

F-2f (1) Type 1.—Expose, in duplicate, specimens (about 3 by 0.75 by 0.064 in.) of bright finished uncoated aluminum alloy sheet, conforming to Federal Specification QQ-A-359, type I, class $^1/_2$H, at 180 F. for 5 hr. (totally immersed) in each of the following concentrations of the detergent in distilled water:

1. The detergent concentration recommended for use by the manufacturer (in water containing the equivalent of 10 grains per gallon of calcium carbonate).
2. A detergent concentration one half the recommended value.
3. A detergent concentration twice the recommended value.

These solutions should be made by dilution from the stock detergent solution. Expose each specimen separately, totally immersed in 50 ml. of the solution under consideration. After 5 hr. exposure, remove the specimens, rinse them with distilled water, and dry. Run a similar test using anodic-oxide-coated specimens instead of bare specimens. If none of the specimens are noticeably altered in appearance as a result of exposure, the detergent is considered to have passed the corrosion test.

F-2f(2) Type II, Class A.—Expose in duplicate, specimens (about 3 by 0.75 by 0.064 in.) of bright finished, uncoated, aluminum alloy sheet conforming to Federal Specification QQ-A-359, type I, class $^1/_2$H, at 180 F. for 5 hr. (totally immersed) in each of the following concentrations of cleaner in distilled water:

1. The cleaner concentration recommended for use by the manufacturer in water containing the equivalent of 10 grains per gallon of calcium carbonate.
2. A cleaner concentration one fourth the recommended value.
3. A cleaner concentration one half the recommended value.
4. A cleaner concentration twice the recommended value.
5. A cleaner concentration four times the recommended value.
6. A cleaner concentration eight times the recommended value.

These solutions should be made by dilution from the stock cleaner solution. Expose each specimen separately, totally immersed in 50 ml. of the solution under consideration. After 5 hr. exposure, remove the specimens, rinse them with distilled water, and dry. Run a similar test using anodic-oxide-coated specimens instead of bare specimens. If none of the specimens are noticeably altered in appearance as a result of exposure, the cleaner is considered to have passed the corrosion test.

F-2f (3) Type II, Class B.—Place about 10 g. of the cleaner on each of two bright finished uncoated aluminum alloy specimens (about 5 by 1.5 by 0.064 in.) conforming to Federal Specification QQ-A-359, type I, class $^1/_2$H. Distribute the cleaner over an area at least 3 by 1 in. in the center of one of the larger surfaces of each specimen. Store the specimens horizontally in an atmosphere saturated with water vapor at 86 F. for 24 hr. At the end of this time, remove the specimens from the test, rinse them in clean cold water, dry with a piece of clean cheesecloth conforming to Federal Specification CCC-C-271, and examine. Repeat the test using anodic-oxide-coated specimens instead of bare specimens. If none of the specimens are noticeably altered in appearance as a result of exposure, the cleaner is considered to have passed the corrosion test.

Air Corps Specification: Compound, Cleaning; Aircraft No. 20015-B, October 12, 1940

F-13.—Make up two bright and clean test strips, about 1 by 4 in., of 24S-T aluminum alloy. Place one test strip in a 10 per cent and the other in a 50 per cent aqueous solution of the compound. Leave for 48 hr. at an approximate temperature of 60 C. (140 F.). No gas shall be evolved during this test and at the completion of the test the rinsed and dried test strips shall be unchanged in appearance.

Army Air Forces Specification: Compound: Carbon Removal (for Engine Parts) No. 20025, June 15, 1942

F-6B.—Place one of the sets of plates upright on an open end in a beaker of the compound under test, and the other in a beaker of the standard compound. Maintain both beakers of liquid at a temperature of approximately 165 F. for 24 hr. Remove from the beakers and separate the component metal plates. Clean each plate with a suitable solvent, dry, and reweigh. Calculate the change in weight per square inch of surface area for each plate. The change in weight per square inch of surface area for each

metal should not be greater in the compound under test than in the standard compound, and the deterioration in appearance should not be greater.

Bureau of Ships ad Interim Specification Detergent, Dishwashing, 51D8 (INT)

F-2g. Corrosion.—Expose, in duplicate, specimens (approximately 3 by 0.75 by 0.064 in.) of bright finished uncoated aluminum alloy sheet, conforming to the requirements for type 1, condition $^1/_2$H, of Federal Specification QQ-A-359, listed in section A, at 180 F. for 5 hr. (totally immersed) in a (1:1) dilution of the stock solution of the detergent in distilled water, maintaining the original level of the solution by addition of distilled water, as may be required. After 5 hr. exposure, remove the specimens, rinse with distilled water, and dry. Examine the specimens for discoloration, etching, or formation of a white film on the surface.

Navy Aeronautical Specification: Compound, Carbon Removal for Aircraft Engine Parts (Cresol Type) C-86b, 24 June 1942, Superseding C-86a, 28 July 1939

F-6g(2). *Corrosiveness.*—Transfer 1 qt. of the solution to a beaker, heat to 57 to 63 C. (135 to 145 F.), and maintaining this temperature, completely immerse each one of the 1 by 6-in., anodized aluminum alloy, polished aluminum alloy, polished copper, and steel strips in the solution for 1$^1/_2$ hr. Remove and rinse. Report any traces of corrosive attack, oxidation, or discoloration of each of the metals.

Navy Aeronautical Specification: Cleaner, Metal, Silicate-Soap, C-109a, 31 March 1942; Superseding C-109, 10 March 1941

F-5i. Corrosiveness.—Transfer 1 qt. of a test solution containing 8 oz. of the compound per gallon of water to a beaker, heat to the specified temperature, and completely immerse 3 by 6-in. panels of the metal specified in the solution and maintain the temperature for 1 hr. Remove and rinse the panels. Report any trace of attack, oxidation, or discoloration of the base metal surfaces.

Navy Aeronautical Specification: Compound, Paint Stripping, Non-inflammable, C-113, 22 September 1941

F-4c. Corrosiveness of Compound.—Test specimens shall consist of 1 by 1-in. panels of each metal specified. The test specimens shall be immersed for 4 hr. in 125 ml. of the compound at approximately room temperature, 25 C. (78 F.), contained in separate 150-ml. beakers and covered with watch glasses. The specimens shall then be removed from the compound, cleaned with acetone, and examined for any possible attack or discoloration.

F-4d. Corrosiveness of Residual Solids.—The compound shall be applied to an unfinished anodized aluminum alloy panel with a brush, and allowed to dry. The panel shall be examined after 48 hr. for any signs of attack or discoloration.

Navy Aeronautical Specification: Compound, Engine Cleaning and Paint Stripping, C-114, Amendment 1, 10 March 1942

F-6b. Corrosiveness.—Place 1 qt. of the test solution in a beaker, heat to the specified temperature, and completely immerse 1 by 6-in. panels of each metal specified, in the solution for 1$^1/_2$ hr., taking care that panels do not touch each other. Remove and rinse the panels and observe any trace of corrosive attack, oxidation or discoloration of each of the metals.

Navy Aeronautical Specification: Compound, Carbon Removal, for Aircraft Engine Parts, C-118, 16 May 1942

F-6d. Corrosiveness.—Place 1 qt. of the test solution in a beaker, heat to the specified temperature and completely immerse 1 by 6-in. panels of each metal specified, in the solution for 4 hr. Remove and rinse the panels and observe any trace of corrosive attack, oxidation, or discoloration of each of the metals. Immersion of the panels shall be repeated in the compound at room temperature for 24 hr. and the panels shall again be examined for attack.

Tank-Automotive Center Tentative Specification: Cleaner, Carburetor, TAC ES-No. 645a, March 17, 1943

Performance Tests: F-2. Corrosion Test.—Completely immerse polished test strips of electrolytic copper, 85–5–5–5 bronze, aluminum, cast iron, and zinc, connected electrically in series with copper wire, in the cleaner at room temperature. Allow to remain immersed for 72 hr.

Tank-Automotive Center Tentative Specification: Metal Conditioner Acid, Concentrated, HQMB ES-No. 431b

E-5. Etching Action.—The metal conditioner shall not attack iron, galvanized iron, brass, or aluminum surfaces more than to produce a very slight etching when allowed to remain in contact with such metal surfaces for ten (10) min. in 3:1 dilution.

Ordnance Department: Corrosion Prevention, Processing and Packaging, Tentative Specification TM 38-305, August 1, 1943

A 60-page specification which outlines procedures for cleaning and prevention of corrosion of the cleaned articles by use of corrosion preventive agents listed in seven government specifications.

Basis for Corrosion Test for Water-Soluble Aluminum Cleaners

The A.S.T.M. Tentative Method of Total Immersion Testing of Non-Ferrous Metals (B 185 – 43 T)[3] broadly outlines the requirements for the type of test under consideration. The discussion which follows provides the basis upon which the present test is designed, and follows the general principles developed in Method B 185.

Apparatus:

The equipment used in making the test should be as simple and as readily available as possible. If the test is of short duration or at relatively low temperature, it may be necessary only to cap the vessel containing the test strip. However, at temperatures near the boiling point there are two methods of approach: the strips may be placed in tightly capped bottles or may be maintained under reflux condensers. Containers should be chosen of such size that the ratio of metal surface exposed to the volume of solution may be held at a constant.

Although almost any temperature of test may be chosen, if maintained suitably, the most severe conditions will

[3] 1943 Supplement to Book of A.S.T.M. Standards, Part I, p. 332.

probably be encountered at the boiling point, since difficulty with corrosion oftentimes occurs through inadvertent loss of control of a cleaning bath. Any constant temperature bath, oven, hot plate, or other method of heating used should be capable of maintaing conditions closely, over the period of time required.

Metal Preparation:

Although precleaning is not specifically mentioned by a number of the investigators quoted, they probably may have neglected mention of this factor, since a clean surface was understood as a necessary requisite to a satisfactory test. A definite cleaning procedure should be followed, and the simpler and less likely this step is to change the surface characteristics of the metal, the more desirable will it be. Thomas (*5*) mentions the preparation of the aluminum surface by etching for a given period of time in a sodium hydroxide bath. This step may be necessary in cases where the surface is already corroded and the corrosion products must be removed, but would not be a suitable procedure where the metal surface has purposely been protectively coated by chemical treatment (anodizing, cladding, and the like). For this reason, inert solvents and some degree of mechanical cleaning of the metal surface are desirable. Communication with Mutchler (*9*) indicates that precleaning should be carried out by thoroughly swabbing the surface of the test strips in several changes of carbon tetrachloride, then in several changes of alcohol. It was indicated that care should be taken to prevent contamination of sample by overuse of the solvent cleaners. The use of methyl alcohol not weaker than 95 per cent concentration to remove perspiration stains is recommended by Ordnance Specification TM 38-305 and should effectively prevent corrosion from such a source.

Test Conditions:

The aluminum corrosion test described by Thomas (*5*) is the only one in which recognition is specifically given to the importance of the ratio of the area of exposed metal to the volume of the test solution. Presumably, however, the other investigators controlled this factor by their panel size, test equipment, and volume of solution, but have not recorded this as an important feature of their investigations. It is possible with advanced corrosion, a large area of metal strip, and small volume (or low concentration) of solution, almost to exhaust the cleaning agent from the bath. Under such circumstances it is probable that such an active corrosive agent would, in any case, be discarded in favor of one of less corrosive character.

In general, however, the area of the test panel or strip may be varied considerably, but Thomas indicated that there should be a definite ratio of exposed metal to the volume of test solution used. Perry (*10*) indicates that there is negligible effect upon corrosion results when the volume of solution is varied between 20 to 200 ml. per sq. in. of area exposed, equivalent to from 0.323 to 3.225 sq. dm. per l. Control of the ratio of exposed metal to solution is a desirable precaution since there will in general be a fairly definite ratio in commercial operations. Method B 185 recommends a ratio of 1 sq. dm. per 4 l. of solution. However, since the present test is designed to be made at several different concentrations, a ratio of 3 sq. dm. per l. was chosen.

Although the ratio of metal area to solution may be defined, sample sizes have been restricted in many cases to the order of 1 in. in width to 3 to 4 in. in length, but in any case where a number of tests are to be made they are generally of a specific size, and such size should be a matter of record.

Although the tests may be carried out at any concentration or series of concentrations desired, they should cover the entire range over which the cleaner might be used and should bear some definite relationship to one another. A pertinent reference at this point is Federal Specification for Detergents for Aluminumware, P-D-236, previously quoted. Provided that the cleaner concentration is known, this recommendation may be taken, in this case one fourth, one half, two, four, and eight times the recommended value.

Method of Test:

Borgmann and Mears (*11*) made a comprehensive survey of the methods for determining the amount and influence of corrosion, while McKay and LaQue (*12*) have shown the need for standardization of liquid corrosion testing. These papers should be consulted for a detailed discussion of these factors.

The test may be made in a variety of ways. It may be made by total or partial immersion technique, and the test strip may be straight, given a full twist or made "L" shaped. For partial immersion the strip must be drilled with a hole from which to suspend it, although no such treatment is necessary for total immersion. The twisted and "L"-shaped strips may be considered special cases in which corrosion under stress or corrosion in the presence of possible galvanic couples may be set up. Since these are special cases, total immersion without imparting any bend or stress to the test strip is probably the most generally accepted test procedure.

Mitchell (3) specified total immersion, since the test is designed to measure both corrosion and gas evolution. Since aluminum is sensitive to caustic alkalies and when attacked will result in the evolution of gaseous hydrogen, measurement of the volume of gas evolved may present a means for quantitative measurement of corrosion. Unless considerable care is taken in control of gas measurement, the error involved may be considerable. Evans (*13*) indicates that corrosion of ferrous metals by alkalies is characterized by localized and random attack, hence that results of this type of measurement are subject to poor reproducibility. Mitchell obviated much of this error for aluminum by also measuring weight gain or loss of the specimen. In other cases where total immersion of sample is employed, there is presumably ample space above the test liquid either to provide for expansion or to permit any gaseous corrosion products to be bled off.

For most stringent conditions, the test should be conducted at the boiling point, preferably over a range of concentrations of definite ratio varying from dilute to highly concentrated. The time intervals may be of 2 hr. duration or some multiple thereof, either until corrosion is evident or until a maximum period of exposure has been attained.

If the test is to be other than a qualitative one, the strip must be accurately weighed shortly after being thoroughly cleaned and dried, and should be transferred at once to the test solution.

Perry (*10*) indicated that duplicate tests should be made. Evans suggests that statistical analysis should be applied to corrosion test results, especially when poor reproducibility is experienced.

Replicates should be two to four or more in number (as discussed below under "Expression of Corrosion Test Results") since if four replicates are chosen in a set of controlled conditions, reference to data shown by Ezekiel (*14*) indicates that 2σ for four samples provides data within this range 86.1 per cent of the time, while six samples will fall within this range 89.8 per cent of the time and ten samples 92.7 per cent of the time. A more specific reference to the application of statistics to testing is that of Humes, Passano, and Hayes (*15*).

Based upon their work and expanded in Method B 185, it is indicated that the expected errors of the averages of different numbers of specimens would be as follows:

Number of Replicates	Error of Average, plus or minus, per cent
8	4.8
4	6.9
2	9.7

According to Method B 185, this would mean that quadruplicate tests would make it highly probable that the average would be within 7 per cent of the true average, and that for routine work duplicate tests could be made with an accuracy of plus or minus 10 per cent.

The test strips after exposure should be rinsed in a standard manner in distilled water at a given temperature, followed by one or more rinse in alcohol, again at a given temperature, finally rinsed in acetone or ether, and then oven-dried at 105 C. for 30 min. The strips should then be cooled in a desiccator and accurately reweighed.

The corroded strip may then be immersed in a beaker containing concentrated (70 per cent) nitric acid at room temperature (*8*) for removal of corrosion products. In some cases these cannot readily be removed, and such information must be reported. The strips, if thus treated, should be rinsed thoroughly in distilled water and then acetone or ether, oven-dried at 105 C. for 30 min., and reweighed.

The appearance of the test strips should be recorded as to visible discoloration, dulling, etching, pitting, types of pitting, accretions, or other unusual change. According to those skilled in corrosion testing of aluminum, the appearance of the test specimen will have at least as much bearing upon the selection of the cleaner as will the quantitative metal loss during the exposure cycle.

If other than a visual, qualitative examination is desired, an area equal to half of one side of a representative test strip may be examined microscopically for determination of the number of pits and the area and depth of each.

Expression of Corrosion Test Results:

Corrosion test results are expressed by McKay and Worthington (*16*) as milligrams loss per sq. dm. per day. Note that under these conditions the area of exposed test piece should be controlled. Another procedure for defining corrosion effect is calculation of corrosion as inches penetration per year. Such a calculation assumes that the corrosion is uniform, without localized pitting.

Mears and Eldredge propose an expression of corrosion whereby:

$$P = \frac{W_1 - W_2}{W_1} \times 100 \quad \ldots\ldots\ldots\ldots (1)$$

where

P = percentage protection,
W_1 = the weight loss of a specimen after a definite period in a corroding solution, and
W_2 = the weight loss of an "identical specimen exposed for the same length of time in a similar solution containing an inhibitor."

Presumably this same system could be used to compare different detergents at equivalent concentrations, other test conditions being maintained constant.

Evans (*13*), on corrosion testing technique, indicates that the greater the number of replicates the greater is the likelihood that test variation will be encountered, which is an indication that some degree of statistical analysis should be applied to the test results. Such analysis assumes that all variable factors are controlled as closely as possible, and that sample variation results from inconsistencies in the material under test.

Some workers may feel that to express the results of four tests on a statistical basis may seem to provide false authenticity, but where a sufficient number of replicates has been made, and where the range of variation has been recorded, such data may prove highly useful. The following information is therefore provided for individual use, but for the present at least, the expression of data has been kept to the simplest possible terms.

The American Society for Testing Materials has published a manual (*17*) on the presentation of data. Their recommendations as applied to the present problems are to present the data as a minimum, the average, the standard deviation, and the number of observations. Standard deviation may be calculated as follows:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} X_i^2}{n} - \overline{X}^2} \quad \ldots\ldots\ldots\ldots (2)$$

where $\sum_{i=1}^{n}$ means "the sum of," for all values of i from $i = 1$ to $i = n$, inclusive; X_i^2 is the squares of the numbers; n is the number of replicates; and $\overline{X}$ is the arithmetic mean, or average.

In addition to standard deviation, the manual suggests an additional value termed coefficient of variation, v, which is obtained from the following equation:

$$v = 100\,\frac{\sigma}{\overline{X}} \quad \ldots\ldots\ldots\ldots (3)$$

A further use for statistical analysis is to ascertain what proportion of observations fall within certain limits, since if $\overline{X}$ and σ are presented, 75 per cent of the numbers lie within the range of $\overline{X} \pm 2\sigma$, or 88.9 per cent lie within the range of $\overline{X} \pm \sigma\pi$, etc.

Another useful term is standard error of the mean $\sigma_{\overline{X}}$, wherein Ezekiel (*14*) suggests the following form:

$$\sigma_{\overline{X}} = \frac{\sigma}{\sqrt{n-1}} \quad \ldots\ldots\ldots\ldots (4)$$

The true value is then:

$$\overline{X} \pm \sigma_{\overline{X}}$$

which means that two times out of three the value will lie within this range, or that in 95.45 per cent of the cases, the true value will lie within twice the standard error. For four observations there are 14 chances out of 100 of differing from the true mean by twice the standard error, and almost 6 chances out of 100 of differing by 3 times the standard error.

A means for comparing two sets of data in which only one variable has been changed is suggested by Fisher (*18*). It is indicated that if the difference between two mean values is equal to, or greater than, twice the larger standard error, there is real difference between samples.

After consideration of the foregoing information, a tentative corrosion test was drawn up and submitted to the contributing members of Section G on Metal Cleaners, of Subcommittee II on Specifications, of A.S.T.M. Committee D-12 on Soaps and Other Detergents. The suggested test appended to this paper, which is in its present form as a matter of convenience, was finally developed as a result of their helpful suggestions and criticisms and is subject to further revision and improvement. The contributing members of Section G are listed as follows:

J. B. Crowe, Procter and Gamble Co., Ivorydale, Ohio.
R. S. Frazer, The Cowles Detergent Co., Cleveland, Ohio.
G. B. Hogaboom, Research Engineer—Electroplating, 557 Stanley St., New Britain, Conn.
C. E. Lennox, Swift and Co., Chicago, Ill.
C. S. Lowe, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.
V. M. Mantz, R. M. Hollingshead Corp., Camden, N. J.
R. B. Mears, Aluminum Company of America, New Kensington, Pa.
W. H. Mutchler, National Bureau of Standards, Washington, D. C.
C. Nielsen, Nielco Laboratories, Detroit, Mich.
C. C. Ross, U. S. Naval Engineering Experiment Station, Annapolis, Md.
F. W. Smither, National Bureau of Standards, Washington, D. C.
O. R. Sutherland, U. S. Navy Yard, Philadelphia, Pa.
T. H. Vaughn, Wyandotte Chemicals Corp., Wyandotte, Mich.

REFERENCES

(*1*) J. C. Harris and R. B. Mears, "Annotated Bibliography of Aluminum Cleaning," ASTM BULLETIN No. 120, pp. 33–36; No. 121, pp. 33–38 (1943); No. 128, pp. 35–40 (1944).

(*2*) O. F. Hunziker, W. A. Cordes, and B. H. Nissen, "Metals in Dairy Equipment—Corrosion Caused by Washing Powders, Chemical Sterilizers, and Refrigerating Brines," *Journal of Dairy Science*, Vol. 12, pp. 252–284 (1929).

(*3*) R. W. Mitchell, "Cleaning Aluminum," *The Metal Industry*, Vol. 28, pp. 171–172 (1930).

(*4*) Chester L. Baker, "Effect of Alkaline Detergents upon Metals," *Industrial and Engineering Chemistry*, Vol. 27, p. 1358 (1935).

(*5*) J. F. J. Thomas, "The Effect of Dishwashing Compounds on Aluminum," *Canadian Journal of Research*, Vol. 19, No. 7, p. 153 (1941).

(*6*) General Chemical Co., Canadian Patent No. 411,280, March, 1943.

(*7*) R. B. Mears and G. G. Eldredge, "The Use of Inhibitors for Aluminum Chemical Equipment," *Preprint No. 83-16*, Electrochemical Soc. (1943).

(*8*) Private communication from Robert B. Mears, Metallurgical Division, Aluminum Research Laboratory, Aluminum Company of America, February 11, 1944.

(*9*) Private communication from W. H. Mutchler, Nat. Bureau of Standards, January 31, 1944.

(*10*) J. H. Perry, "Chemical Engineering Handbook," p. 1723. McGraw-Hill Book Co., Inc., New York, N. Y. (1941).

(11) C. W. Borgmann and R. B. Mears, "The Principles of Corrosion Testing," Symposium on Corrosion Testing Procedures, pp. 3–35, Chicago Regional Meeting, Am. Soc. Testing Mats. (1937). Symposium issued as separate publication.

(*12*) R. J. McKay and F. L. LaQue, "Standardizing Liquid Corrosion Tests," Symposium on Corrosion Testing Procedures, pp. 87–94, Chicago Regional Meeting, Am. Soc. Testing Mats. (1937). Symposium issued as separate publication.

(*13*) U. R. Evans, "Metallic Corrosion, Passivity and Protection," Edward Arnold and Co., London (1937).

(*14*) Mordecai Ezekiel, "Methods of Correlation Analysis," John Wiley and Sons, Inc. (1930).

(*15*) C. H. Humes, R. F. Passano, and A. Hayes, "A Study of the Error of Averages and its Application to Corrosion Tests," *Proceedings*, Am. Soc. Testing Mats., Vol. 30, Part II, p. 448 (1930).

(*16*) R. J. McKay and Robert Worthington, "Corrosion Resistance of Metals and Alloys," p. 147, Reinhold Publishing Corp., New York, N. Y. (1936).

(*17*) ASTM Manual on Presentation of Data, Am. Soc. Testing Mats. (1940).

(*18*) R. A. Fisher, "Statistical Methods for Research Workers," Oliver and Boyd, Edinburgh and London, Eighth Edition, 1941.

Suggested Immersion Corrosion Test for Water-Soluble Aluminum Cleaners

Scope:

1. This test is intended as a means for determining the corrosive effects of water-soluble aluminum cleaners upon aluminum or aluminum alloys, under conditions of total immersion at boiling temperature, by (*a*) quantitative measurement of weight loss or (*b*) qualitative visual determination of change. The test is designed for the determination of corrosion characteristics of the cleaner and not for determination of cleaner life.

Apparatus:

2. (*A*) *Test Tubes.*—These may be standard Pyrex test tubes either 38 mm. in diameter by 300 mm. in length, capacity about 300 ml., or 25 mm. in diameter by 200 mm. in length, capacity about 100 ml. The tubes are to be chosen so that the specimens remain fully immersed during the test, fulfill the ratio of area of immersed metal to the volume of solution of Section 4 (*A*), and provide sufficient space for foam formation if foam is formed by the cleaner.

(*B*) *Condensers.*—These shall be the Allihn type, of about 200 to 250 mm. jacket length.

(*C*) *Stoppers.*—The connections between test tube and condenser optionally may either be standard-taper joints, or of rubber preboiled in aqueous caustic soda to remove free sulfur and boiled in a sufficient number of changes of distilled water until neutral.

(*D*) *Constant Temperature Device.*—Any suitable means may be employed for maintaining the solutions actively at the boiling point.

Metal Preparation:

3. (*A*) *Metals.*—Aluminum, aluminum alloys protectively coated, or bare metals may be used as required.

(*B*) *Size of Strips.*—A specimen size suitable for quantitative estimation, which can be tested in tubes 38 by 300 mm. in size, is 25 by 75 by 1 mm. (see Section 4 (*A*)). Specimens 18 by 75 mm. in size can be tested in tubes 25 mm. in diameter by 200 mm. in length. Any other size of sample may be used, but in any case the sample size shall be reported.

(*C*) *Number of Specimens.*—At least two, and preferably four, replicates shall be tested in each concentration of

cleaner solution. The number of replicates under test shall be reported.

(*D*) *Preparation of Specimens:* (*1*) *Selection of Samples.*—The samples selected for corrosion testing shall be identical in composition, metallurgy, and surface finishing with the conditions of the metal at the stage where cleaning will be applied in practice. Burred edges or other surface imperfections not normally present on the sample either shall be removed, or where removal would change surface finish characteristics, another sample, if available, shall be chosen. Samples shall be chosen which are free from iron or iron compounds such as mill scale, or such contamination shall be removed in cases in which removal will not alter surface finish.

(*2*) *Protection of Cut Edges.*—The edges of Alclad aluminum alloy or other surface-treated metal shall be left bare if the metal is to be placed in service under these conditions. If the metal edges are to be protected in service they shall be carefully coated 2 to 4 mm. back from the edges with an alkali and temperature-resistant stop-off lacquer such as "Dulac," manufactured by Maas and Waldstein Co., Newark, N. J., or other suitable lacquer as agreed upon. The area of metal surface exposed shall be measured, and only the bare metal surface shall be used in the calculation of the ratio of area immersed to volume of test solution (Section 4 (*A*)).

(*3*) *Precleaning Materials.*—The following cleaning materials shall be made ready for removal of soil present on the metal surface prior to immersion corrosion testing:

(*a*) A 250-ml. beaker containing 200 ml. of carbon tetrachloride or trichloroethylene at room temperature.
(*b*) A 1-liter beaker containing 150 to 200 ml. of hot carbon tetrachloride or trichloroethylene, the degree of vaporization being controlled to permit vapor degreasing of the specimens when held in the beaker, or alternatively a wash bottle containing either of these solvents at 25 to 30 C.
(*c*) A 250-ml. beaker of either anhydrous methanol or isopropanol at 50 C.
(*d*) A 250-ml. beaker of distilled water at 50 C.
(*e*) A 250-ml. beaker of acetone at room temperature.
(*f*) A small swab of fresh absorbent cotton placed in each of the beakers.

(*4*) *Precleaning Technique:*

(*a*) Immerse the test strips in the beaker of carbon tetrachloride or trichloroethylene (see Section 3(*D*)(3)) and immediately swab the surfaces of the individual strips thoroughly, using clean forceps to hold both the cotton swab and the test strip.
(*b*) After the swabbing of each strip is completed, shake off excess solvent and either transfer the strip to the vapor degreasing bath long enough to observe the vapor completely covering and condensing on the strip, or thoroughly wash the strip with a stream of fresh solvent from the wash bottle.
(*c*) Swab the strips separately in the beaker of alcohol.
(*d*) Shake free from excess alcohol and transfer to the beaker of distilled water. Swab carefully and shake free from excess water.
(*e*) Immerse the strips separately several times in the beaker of acetone, shake free from acetone, and place them in a beaker, spacing the specimens for maximum exposure of surface area (do not stack or pile the specimens in the beaker).
(*f*) Transfer the strips immediately to an oven at 105 C.

NOTE—When these directions are followed the strips will be free from acetone, but precaution should be taken to prevent ignition of acetone vapors in the oven which might result in an explosion.

Test Conditions:

4. (*A*) *Ratio of Area of Immersed Metal to Volume of Solution.*—Predetermine the volume of solution required, so that the ratio of the area of immersed metal to the volume of test solution is maintained at 3 sq. dm. per l. A corrosion strip of 25 by 75 by 1 mm. (total area 0.395 sq. dm.) (Section 3 (*B*)) will require 135 ± 5 ml. of cleaner solution. If necessary to use another ratio, it should be indicated and recorded.

NOTE.—If a stop-off lacquer has been used to protect freshly cut edges the ratio of the area exposed to the volume of solution shall be calculated on the basis of actual metal exposed, exclusive of the lacquer-protected area.

(*B*) *Solution Concentration.*—(*1*) The specimens shall be tested in cleaner solution of the volume specified in Section 4 (*A*) and at solution concentrations of 0.125, 0.25, 0.5, 1.0, 4.0, 8.0, and 16.0 per cent. In case the cleaner is not soluble to the extent noted, this fact shall be recorded, but the test shall nevertheless be continued with those amounts of cleaner.

(*2*) In case the cleaner manufacturer's recommendations are available, the test may optionally be made at the following relative concentrations, recording the percentage which these represent:

(*a*) One fourth the concentration recommended,
(*b*) One half the concentration recommended,
(*c*) At the concentration recommended,
(*d*) Twice the concentration recommended, and
(*e*) Four times the concentration recommended.

(*C*) *Water.*—The cleaner of desired concentration shall be dissolved in freshly boiled distilled water. Optionally water of any given characteristics may be used (it should not be boiled) but its hardness or other pertinent characteristics shall be recorded.

NOTE.—A blank test for comparison purposes may be made by immersing either two or four specimens in either freshly boiled distilled water, or water of the type being used, submitting them otherwise to exactly the same procedure followed for the samples immersed in cleaner solution.

Methods of Test:

5. Two methods of test, a quantitative weight loss method and a qualitative surface corrosion method, are outlined as follows:

Quantitative Weight Loss Method

(*A*) Dry the cleaned strips from Section 3 (*D*) (*4*) (*f*) in an oven at 105 C. for 30 min. Remove, cool in a desiccator, and weigh to 0.0001 g.

(*B*) Transfer the corrosion specimens to the preheated cleaner solutions (see Section 4 (*B*)), using only one specimen per tube. Attach the tube containing the strip to a reflux condenser and maintain the solution at the boiling point.

(*C*) Expose for a period of 2 hr. Other exposure periods may optionally be observed but must be recorded in Section 6.

(*D*) Remove the strips at the end of the exposure period and proceed as follows:

(1) Hold the specimens in forceps and rinse them thoroughly in a 1-liter beaker into which tap water is actively flowing.

(2) Rinse thoroughly in distilled water at room temperature (25 to 30 C.).

(3) Follow with a rinse in 200 ml. of either anhydrous methanol or isopropanol at room temperature.

(4) Finally dip in clean acetone, shake free from acetone droplets and transfer to a clean, dry beaker.

(5) Dry 30 min. at 105 C., cool in a desiccator, and weigh to 0.0001 g.

(6) Record any of the following visible changes in comparison with the original cleaned, untreated specimen:

(*a*) Discoloration,
(*b*) Dulling,
(*c*) Etching,
(*d*) Presence of accretions and relative amounts, and
(*e*) Types of pitting: wide, medium, or narrow.

Qualitative Surface Corrosion Test

(*A*) Transfer the cleaned, acetone-free strips from Section 3 (*D*) (*4*) (*f*) to the preheated cleaner solution (see Section 4 (*B*)), using only one specimen per tube. Attach the tube containing the strip to a reflux condenser and maintain the solution at the boiling point.

(*B*) Proceed as in Section 5 (*C*).

(*C*) Proceed as in Section 5 (*D*) (*1*) to 5 (*D*) (*4*), and 5 (*D*) (*6*).

Expression of Results:

6. Report the following data for *each* of the cleaner concentrations tested:

(*Quantitative Weight Loss Method*)

(*1*) *Water Used.*

(*2*) *Specimens.*—Report size and number of specimens tested.

(*3*) *Metal.*—Specify the metal, alloy, and/or surface treatment. Record ratio of surface area exposed to volume of solution.

(*4*) *Solubility.*—Report lack of solubility of cleaner (if insoluble at any of the concentrations tested).

(*5*) *Weight Loss.*—Calculate the average number of milligrams loss in weight per sq. dm. per 2 hr.

(*6*) *Range.*—Report maximum and minimum values of weight loss for each of the cleaner concentrations tested.

(*7*) *Appearance:*

(*a*) Discoloration,
(*b*) Dulling,
(*c*) Etching,
(*d*) Presence of accretions and relative amounts, and
(*e*) Type of pitting: wide, medium, or narrow.

(*Qualitative Surface Corrosion Method*)

(*1*) Report the same information as for the quantitative weight loss test, except that Item (*5*) on weight loss and Item (*6*) on range shall be omitted.

New A.S.T.M. Technical Committee on Adhesives

Broad Field of Work for Committee D-14

An important new standing technical committee has been organized by the Society to function in the field of adhesives. This committee, having been authorized by the Executive Committee some months ago, was formally organized at a meeting at A.S.T.M. Headquarters in Philadelphia late in June, at which the technical men who are serving as members of the committee, representing leading producers and consumers of adhesives, discussed problems in connection with scope, important activities which needed to be started, personnel, etc.

T. R. Truax, Principal Wood Technologist, U. S. Forest Products Laboratory, Madison, Wis., who had been appointed temporary chairman of the committee, presided at the meeting. Other temporary officers who will serve are P. H. Bilhuber, Steinway & Sons, New York, Vice-Chairman, and Henry Grinsfelder, Senior Engineer, Resinous Products and Chemical Co., Philadelphia, Secretary.

A preliminary statement of scope of the Committee is as follows:

The formulation of specifications, methods of test, and definitions of terms pertaining to adhesives, including animal, vegetable, mineral, and synthetic types.

Following the setup of most A.S.T.M. technical committees, a number of subgroups are being appointed to be responsible for specific projects in this field of activity. A list of the subcommittees with some indication of their responsibilities follows:

I. Subcommittee on Strength Tests (M. H. Bigelow, Chairman), Shear, tension, compression, torsion, vibration, etc.
II. Subcommittee on Analytical Tests (Leonard Repsher, Chairman), Viscosity, acidity, fillers, etc.
III. Subcommittee on Tests for Permanency (F. J. Wehmer, Chairman), Moisture, temperature, chemicals—oils, salt, etc., microorganisms, etc.
IV. Subcommittee on Working Qualities (C. B. Hemming, Chairman), Working life, assembly time, rate of setting, gluing pressure, etc.
V. Subcommittee on Specifications (Gerald Reinsmith, Chairman), Synthetic resins, starch, animal, casein and vegetable proteins, cellulose, mineral rubber, bituminous, etc.
VI. Subcommittee on Nomenclature and Definitions (G. M. Kline, Chairman).

It has become increasingly evident, through suggestions received by the Society from industry and government and through work of other A.S.T.M. standing committees, that initiation of standardization work and promotion of research on the properties of adhesives were important matters

Officers of Committee D-14 on Adhesives. P. H. Bilhuber, Vice-Chairman, T. R. Truax, Chairman; and Henry Grinsfelder, Secretary.

which should be of considerable benefit to industry, both from the standpoint of producer and consumer. A year ago, the Society's Committee D-20 on Plastics, pending formation of the new Adhesives Committee (which has been designated D-14) started urgent work involving specifications for synthetic resinous adhesives which activity was of much importance to certain branches of the Army. Development of standard test methods was a particularly complicated problem, but, after several meetings, there has been agreement on certain basic considerations, and important progress is being made. Now, with Committee D-14 getting under way, the work on resinous adhesives has been transferred to it.

While there has been, particularly of late, an increasing amount of information and data on adhesives, it is apparent there is an urgent need to develop and correlate authoritative data, particularly on the properties of various types and reliable methods of determining these properties.

It will be the problem of the new A.S.T.M. standing committee to sponsor any necessary research to develop adequate test methods, and, when agreement has been reached on testing procedures, the committee will be in a position to consider the preparation of standard performance specifications.

COMMITTEE PERSONNEL

Adhesives Manufacturers Assn. of America, E. J. Steiger
American Can Co., R. P. Bigger
American Cyanamid Co., F. B. Detwiler
Andover Kent Aviation Corp., T. A. Sharp
Armour & Company, F. W. Colt
Bakelite Corp., Leonard Repsher
B. B. Chemical Co., Thomas C. Morris
Beech Aircraft Corp., Merle M. LaMar
Bell Telephone Labs., Inc., C. J. Frosch, R. C. Platow, R. Burns
Casein Co. of America, F. R. O'Hare
Chrysler Corp., Cycle-Weld Div., S. G. Saunders
Committee D-6 on Paper and Paper Products, C. C. Heritage
Committee D-11 on Rubber Products, J. F. Anderson
Continental Can Co., Inc., G. H. Bendix
Douglas Fir Plywood Assn., John Ritchie
E. I. du Pont de Nemours & Co., J. W. Clough
Durez Plastics & Chemicals, Inc., Jay Searer
General Electric Co., J. D. Nelson
Gummed Industries Assn., The, Fred Farrell
Haskelite Manufacturing Corp., J. H. Tigelaar
Curtiss-Wright Corp.
I. F. Laucks (Laucks Labs., Inc.)
Massachusetts Inst. of Tech., Albert G. H. Dietz
Minnesota Mining & Mfg. Co., F. J. Wehmer
Monite Waterproof Glue Co., Arthur Weber
National Bureau of Standards, G. M. Kline, W. H. Smith
National Lumber Mfgrs. Assn., F. J. Hanrahan
Naval Air Experimental Station, A. P. Dowling
Robert J. Nebesar (Universal Moulded Products Corp.)
Paisley Products, Inc., Laurent J. La Brie
Pennsylvania Coal Products Co., Philip H. Rhodes
Philadelphia Quartz Co., John H. Willis
Plaskon Div., Libbey-Owens-Ford Glass Co., J. Alden Murray
Resinous Products & Chemical Co., Henry Grinsfelder
Joseph F. Seagrams & Sons, Inc., A. Herman
A. F. Staley Mfgr. Co., L. O. Gill
Stein, Hall & Co., Inc., Edward E. Moore
Steinway & Sons, P. H. Bilhuber
Swift & Company, H. H. Young
Tech. Assn. of the Pulp & Paper Industry, R. G. Macdonald
T. R. Truax (U. S. Forest Products Lab.)
U. S. Army, Chemical Warfare Service, M. H. Bigelow
U. S. Army, Ordnance Dept., Gerald Reinsmith
United States Plywood Corp., Charles B. Hemming
Van Cleef Brothers, Paul Van Cleef
U. S. War Dept., Army Air Forces, Wright Field, Lt. Col. Don Brouse

General Revision of Canadian Electrical Code, Part I

CONSIDERATION is now being given to a general revision of the Canadian Electrical Code, Part I, preparatory to the publishing of a Fifth Edition. Subcommittees have been organized to review the various sections of the code and are now actively engaged in the work of revision.

Any and all proposals for revision will be welcome and should be submitted without delay to the Canadian Standards Assn., National Research Building, Ottawa, in order that fullest consideration may be given *well in advance of the closing date* for receipt of proposals. All such proposals should, if possible, be in the form of the actual text desired for incorporation as new or revised Rules in the Fifth Edition of the Code.

The closing date for receipt of proposals for revision is October 1, 1944. Requests for revision, received after that date, may be held for consideration in the next subsequent general revision.

Research and Railroad Progress

UNDER A heading, "Research the Key to Railroads' Progress," the June issue of "Train Talks," a pamphlet issued by The Pennsylvania Railroad Co. to its patrons, outlines in an interesting and instructive manner the very extensive test work carried on by the Pennsylvania's Test Department at Altoona and briefs a number of interesting research projects. The article states that "progress in the art of railroad transportation, throughout the development of the industry, has been inspired by the fruits of research. To railroad men, research means the organized, scientific endeavor constantly to invent better equipment, facilities and methods of operation and to improve those already in use. Railroads conduct research, individually, as separate companies; collectively, through the Association of American Railroads; and cooperatively, with equipment manufacturing companies in all fields. Research is animated by constructive imagination, enterprise and vision." The article goes on to describe the Test Department and the great diversity and extent of its research and test work, listing many projects that are directly related to the field of engineering materials. There is brief description of the locomotive test plant; the Claymont and Elkton tests to determine the extent and causes of the stresses produced in track; and other investigations. A.S.T.M. members who wish to procure a copy of June, 1944, "Train Talks" can do so by contacting Mr. G. E. Payne, Room 1587, Suburban Station Building, Philadelphia 4, Pa.

Fatigue Tests on Compressed and Impregnated Laminated Wood*

By Albert G. H. Dietz[1] and Henry Grinsfelder[2]

SYNOPSIS

Wood veneers combined with phenolic resin are bonded at sufficiently high temperatures to set the resin and are simultaneously compressed to a fraction of their former thickness to yield high-density, high-strength material. Similarly, veneers impregnated with phenolic resin are compressed at high temperatures and pressures into strong, dense materials. In some instances the material is cross-banded, in others it is laminated. The resulting board is used for aircraft propellers and other purposes in which it is subjected to vibrating loads and stresses. In this paper are presented the results of a series of tests undertaken to determine the endurance characteristics and fatigue limits of a number of representative materials of the type described. The material, specimens, test methods, and results are set forth.

For some years, wood has been combined under pressure with phenol-formaldehyde resin to form hard, high-density, high-strength boards. This material goes by various trade names, but two principal types are found:

1. Thin wood veneers interleaved with sheets of phenolic resin film, or sprayed with phenolic resin solution, and bonded at high pressures and temperatures. This is customarily, but not necessarily, cross-banded.

2. Wood veneers impregnated with phenolic resin solutions, laid up to appropriate thickness, and bonded at high pressures and temperatures. This is generally straight laminated, but may be cross-banded.

Both types undergo marked compression, accompanied by corresponding increases in density and strength.

Material of this kind is employed in aircraft propellers and other parts in which it is subject to vibration and repeated stresses. Like other materials, it fails at repeated stresses lower than those required for static failure, but little information is available respecting its behavior under such stresses. To investigate the endurance behavior and to determine "fatigue limits" of various combinations of high-density materials, the program of research here reported was undertaken.

Materials and Specimens

Twelve panels of high-density material were made up, as summarized in Table I. Four (A, B, C, D) were veneer interleaved with phenolic resin film adhesive, three (E, F, G) were veneer spread with medium polymer liquid resin adhesive possessing some penetrating power, the others were veneers impregnated with low polymer phenolic resin. One (D) was cross-banded, the others were not. Panels H and J were duplicates in construction, but contained 25 and 42 per cent resin, respectively; panels E and G were duplicates except for pressing temperatures. Three different low-polymer phenolic impregnants, designated A, B, and C, were represented. Bonding pressures ranged from 2500 to 1050 psi. Temperatures were all very nearly 300 F.

Panels were generally 12 in. square and 1/2 to 3/4 in. thick. Exceptions were panels K and L, which were commercial material. Panel K was 1 1/8 in. thick, and consisted of four pieces 3 in. wide and 12 in. long. Panel L was a piece approximately 17 by 26 in. in size.

From each panel five modulus of rupture specimens 1 in. wide and 12 in. long were cut. In addition, twelve to fifteen rotating-beam specimens were fabricated for the endurance and fatigue limit tests. Panel K was first halved in thickness, and the various specimens were cut from the halves.

TABLE I.—COMPOSITION AND BONDING PROCEDURE.

	Composition		Bonding		
Type	Veneers	Resin	Time, min.	Temperature, deg. Fahr.	Pressure, psi.
A...	1/28-in. maple, 60 ply	Phenolic resin film	30	300	2500
B...	1/48-in. birch, 60 ply	Phenolic resin film	30	300	2500
C...	1/28-in. birch, 35 ply	Phenolic resin film	30	300	2500
D..	1/28-in. birch, 35 ply, cross-banded	Phenolic resin film	30	300	2500
E...	1/16-in. maple, 20 ply	Medium polymer phenolic coating	30	300	1500
F...	1/16-in. birch, 20 ply	Medium polymer phenolic coating	30	300	1500
G...	1/16-in. maple, 20 ply	Medium polymer phenolic coating	30	350	1500
H..	1/16-in. maple, 20 ply	Low polymer A, 25 per cent impregnation	30	300	1500
J...	1/16-in. maple, 20 ply	Low polymer A, 42 per cent impregnation	30	300	1500
K..	1/8-in. maple, 9 ply	Low polymer B, impregnated	30	320	2800
L...	1/16-in. birch, 15 ply	Low polymer C, impregnated	45	304	1050

Although the rotating beam specimens were circular in cross-section, it was felt that modulus of rupture specimens should be of rectangular cross-section because the values resulting would be comparable to those usually obtained in tests of this type. It is recognized that circular modulus of rupture specimens would probably have yielded different results.

Rotating-beam specimens were fabricated in accordance with Federal Specifications LP 406 and are shown in Fig. 1. A number of specimens were made with straight shanks as shown in the lower drawing, but the majority were curved shank. Straight-shank specimens were employed at higher stresses, where experience demonstrated that there was no material difference in the behavior of straight and curved shanks (Figs. 4 to 6).

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

* Presented at the Forty-seventh Annual Meeting, Am. Soc. Testing Mats., New York, N. Y., June 26-30, 1944.

[1] Assistant Professor of Structural Design and Materials, Department of Building Engineering and Construction, Massachusetts Institute of Technology, Cambridge, Mass.

[2] Senior Engineer, The Resinous Products and Chemical Co., Philadelphia, Pa.

Testing Procedure

Static Tests:

Modulus of Rupture and Modulus of Elasticity.—Specimens were freely supported at the ends and loaded at the center. Deflection readings were taken at the center on a dial gage calibrated to thousandths of an inch. Deflections were noted until the proportional limit was passed, at which point the gage was removed and loads carried to failure. Loads were applied at such a rate as to require approximately 20 min. for the test.

Specific Gravity:

Modulus of rupture specimens were measured to the nearest hundredth inch and weighed to the nearest gram. From the weights and volumes so determined, the specific gravities of the individual specimens were calculated and an average determined for each panel.

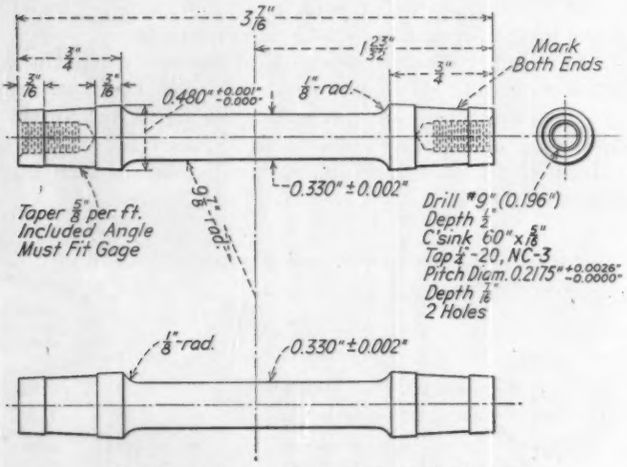


Fig. 1.—Rotating Beam Fatigue Specimen.

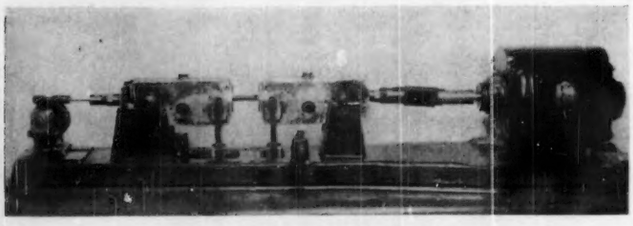


Fig. 2.—Rotating Beam Test.

Modulus of rupture, modulus of elasticity, and specific gravity determinations are summarized in Table II.

Rotating-Beam Tests:

As shown in Fig. 2, specimens were placed in a standard rotating-beam machine, in which a constant bending moment is applied to the specimen. As it rotates, any given point on the periphery is stressed alternately in tension and compression. The machine was operated at 1750 rpm.

The original program was based upon alternating stresses of 80, 60, 45, 35, and 25 per cent of the modulus of rupture.

It was soon found that above 60 per cent, failure occurred so rapidly that the results were of doubtful value.

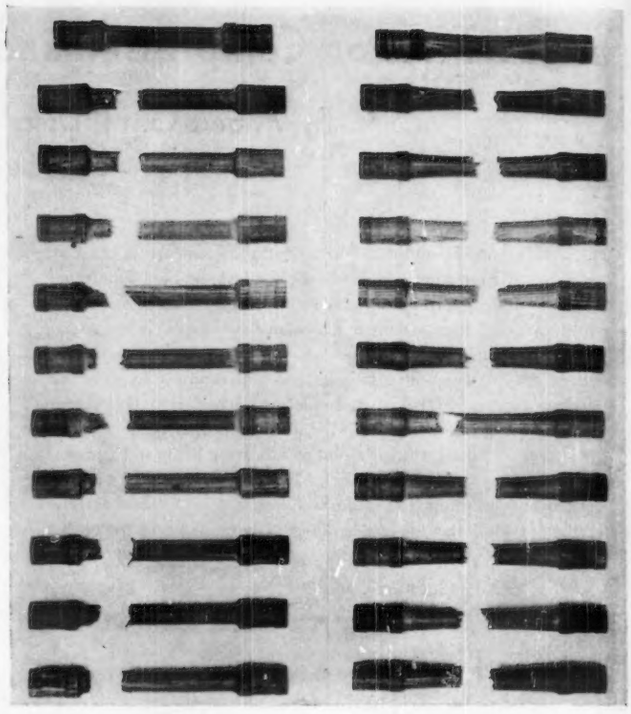


Fig. 3.—Straight and Curved Shank Rotating Beam Specimens A to L.

Top (specimen A) is unbroken, balance are specimens of individual types. Break is characteristic brash—appearing failure found in fatigue specimens.

The balance of the tests were consequently begun at 60 per cent.

After completion of the original program it was found desirable to run additional tests at approximately 30 to 40 per cent of the modulus of rupture on most of the panels, in order to determine the "fatigue limit" more closely than was possible with the original results. At the lower percentages of modulus of rupture, three specimens were

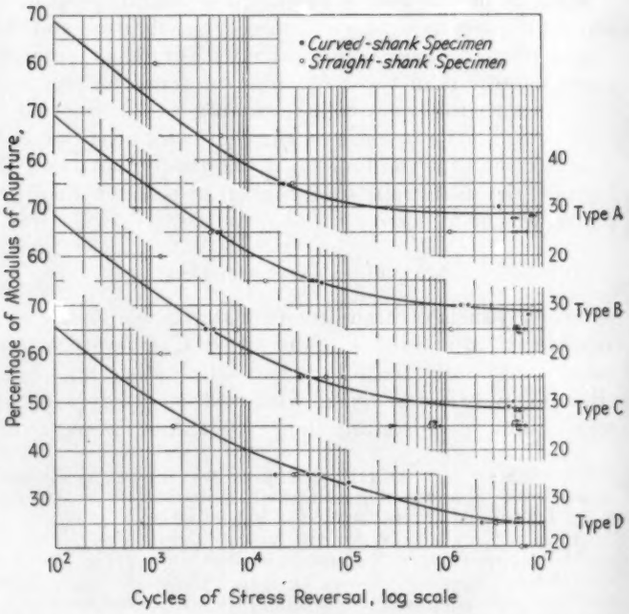


Fig. 4.—*S-N* Curves for Phenolic Resin-Film Bonded and Compressed Materials.

TABLE II.

Type	Specific Gravity	Modulus of Rupture, psi	Modulus of Elasticity, psi.	Fatigue Limit		Ratios	
				Stress, psi.	Per Cent Modulus of Rupture	Column 3 / Column 2	Column 5 / Column 2
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
A	1.40	36 100	2 720 000	10 500	29	25 800	7480
B	1.41	41 100	2 710 000	11 950	29	29 100	8400
C	1.39	47 500	3 710 000	13 500	28	34 200	9740
D	1.36	29 900	2 290 000	7 500	25	22 000	5500
E	1.38	34 000	2 800 000	10 200	30	24 600	7400
F	1.40	32 700	2 750 000	9 180	28	23 400	6560
G	1.36	26 800	2 360 000	7 780	29	19 650	5800
H	1.37	33 100	3 020 000	12 600	38	24 200	9310
J	1.37	31 400	2 710 000	11 950	38	22 950	8720
K	1.33	37 600	3 010 000	10 900	29	28 400	8370
L	1.32	39 800	3 490 000	11 950	30	30 200	9060

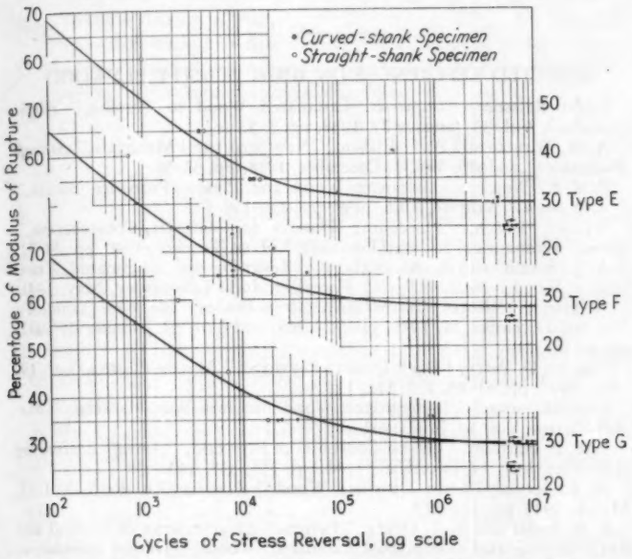


Fig. 5.—*S-N* Curves for Medium-Polymer Phenolic Solution Bonded and Compressed Materials.

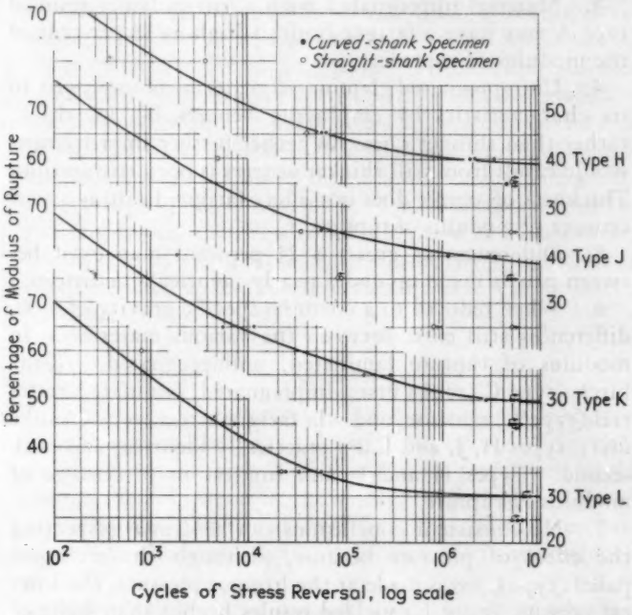


Fig. 6.—*S-N* Curves for Low-Polymer Phenolic Resin Impregnated and Compressed Materials.

run at each stress in order to obtain a reliable average. Tests were carried to failure or to 5,000,000 cycles, under ordinary atmospheric conditions.

Test Results

Test results are summarized in Table II and in Figs. 4 to 6.

In Table II, the modulus of rupture and fatigue limits are divided by the specific gravities (columns 7 and 8) to place all results on a comparable basis.

In Figs. 4 to 6, the rotating-beam results are plotted on semilogarithmic paper as cycles of stress reversal against percentage modulus of rupture. Curves are extrapolated at the left to 100 per cent modulus of rupture at one cycle of stress (static test). They are carried out at the right to the best average of the broken and unbroken specimens in the range 1,000,000 to 5,000,000 or more cycles.

In Fig. 3 are illustrated straight-shank and curved-shank specimens. In each Figure the specimens are arranged in order of panel numbers from top to bottom with an unbroken specimen from panel A at the top. Breaks are the characteristic fatigue failures found in materials of this nature, and are abrupt, brash-looking, rather than fibrous. This is typical also of plain wood and plywood.

The following appear to be the most important results:

1. All endurance curves are quite similar. None are straight lines, and all flatten out to a practically horizontal line in the vicinity of 5,000,000 cycles.

2. Eight of the eleven curves show a fatigue limit in the range 28 to 30 per cent of modulus of rupture. One drops to 25 per cent, two rise to 38 per cent.

3. The highest individual modulus of rupture and highest fatigue stress, both actual and in terms of ratio of stress to specific gravity, are exhibited by panel C, which is $^1/_{28}$-in., 35-ply birch, interleaved with resin film, bonded at 300 F., 30 min., at 2500 psi.

4. The lowest results in terms of percentage of modulus of rupture and fatigue stress are given by panel D, which is the same as C, but cross-banded.

5. In panels A, B, and C, there is a regular progression of all strength characteristics from the very thin veneers ($^1/_{85}$ in.) to the thickest ($^1/_{28}$ in.). The progression is somewhat complicated by the fact that panel A is maple and the other two birch, but the trend is apparent.

6. The highest percentages of modulus of rupture are given by panels H and J, $^1/_{16}$-in., 20-ply maple impregnated with low-polymer phenolic resin, bonded 30 min. at 300 F. and 1500 psi.

7. Panels H and J (similar construction, different resin content) are fairly comparable, panels E and G (similar except for pressing temperatures) are quite different except for the percentage of modulus of rupture at the fatigue limit. The difference in panels E and G is only partially accounted for by the difference in specific gravity.

Conclusions

The following conclusions are drawn from the preceding tests made with rotating-beam specimens at room temperature, and within the limits of the tests.

1. Both impregnated and unimpregnated materials, when laminated and not cross-banded, have fatigue limits averaging close to 30 per cent of the modulus of rupture, except for low-polymer A impregnated materials.

2. Cross-banded, unimpregnated material has a fatigue limit approximately 25 per cent of the modulus of rupture (based upon one panel).

3. Material impregnated with a low-polymer resin of type A may have a fatigue limit as high as 38 per cent of the modulus of rupture.

4. Unimpregnated, laminated material is improved in its characteristics by employing veneers $^1/_{28}$ in. thick, rather than thinner ones. Whether further improvement would result from still thicker veneers is open to question. Thickness of veneer does not affect fatigue limit as a percentage of modulus of rupture.

5. Differences as great as 25 per cent may exist between panels made up under nearly identical conditions.

6. When reduced to a common specific gravity of 1.00, differences still exist between the various materials. In modulus of rupture laminated, unimpregnated, $^1/_{28}$-in. birch (type C) ranks first; impregnated, laminated material (type L) ranks second. In fatigue stress, type C ranks first; types H, J, and L are practically identical and rank second. Types H and J rank highest in percentage of modulus of rupture.

7. No consistent conclusions can be drawn respecting the effect of pressure because, although the strongest panel (type C) was made at the highest pressure, the lowest pressure (type L) yielded results higher than some of the panels at higher pressure. Characteristics of the wood itself are probably more important than pressure in the range 1050 to 2500 psi.

8. No consistent conclusions can be drawn respecting maple and birch. Highest strengths were obtained with birch, but other birch panels were less strong than maple panels. Types H and J, showing highest percentage modulus of rupture, are maple. Quality of the individual veneers is probably more important than species, in two such similar materials as maple and birch.

Acknowledgments:

Acknowledgments are particularly due to S. D. Bailey of Resinous Products and Chemical Co. who was responsible for the preparation of material; to John Barry, Research Assistant, who performed most of the detailed routine testing, and to W. M. Murray of the Materials Testing Laboratory at the Massachusetts Institute of Technology, who was instrumental in setting up the testing procedure.

SELECTED REFERENCES ON HIGH DENSITY PLYWOOD

Edgar Reissner, "Improved Laminated Wood in Torsion," *Flight* (London), Vol. 33, January 27, 1938, pp. 3–5.

A. H. Tiltman and A. E. Ellison, "New Structural Materials," *Aircraft Production* (London), Vol. 1, December, 1938, pp. 52–58.

Fred E. Weick, "Composite Wood and Plastic Propeller Blades," *S.A.E. Journal*, Vol. 44, June, 1939, pp. 252–258.

William Kuech, "Hardening Plastics for Aircraft Construction," *Journal* Aeronautical Society (London), Vol. 44, January, 1940, pp. 44–72.

A. J. Stamm and R. M. Seeborg, "Resin-Treated, Laminated, Compressed Wood," *Bulletin R-1268*, Forest Products Laboratory, May, 1941.

W. Brierley, "Rotol Jablo Wood Airscrew Blades," *Aeroplane* (London), Vol. 61, December 26, 1941, pp. 704–705, and Vol. 62, January 2, 1942, pp. 14, 15, 21.

Thomas D. Perry, "High Density Plywood," *Modern Plastics*, Vol. 19, May, 1942, pp. 61–63, 110, 112, 114.

John Delmonte, "Impregnated Wood Becomes War Material," *Machine Design*, Vol. 14, July, 1942, pp. 53–57.

R. F. S. Harmon, "Elastic Constants of Plywood," *Aircraft Engineering* (London), Vol. 14, December, 1942, pp. 336, 337, 340.

A. E. Jervis, "Resin Densified Wood," *Plastics* (London), Vol. 7, March, 1943, pp. 122–127.

F. B. Fuller and T. T. Oberg, "Fatigue Characteristics of Natural and Resin Impregnated Compressed Laminated Woods," *Journal Aeronautical Sciences*, Vol. 10, March, 1943, pp. 81–85.

Malcolm Finlayson, "High Density Plywood," *Transactions*, Am. Soc. Mechanical Engrs., Vol. 65, April, 1943, pp. 193–200.

A. G. H. Dietz and Henry Grinsfelder, "Behavior of Plywood Under Repeated Stresses," *Transactions*, Am. Soc. Mechanical Engrs., Vol. 65, April, 1943, pp. 187–192.

Ralph Casselman, "Resin Impregnation of Wood," *Mechanical Engineering*, Vol. 65, October, 1943, pp. 737, 738, 744.

Louis Klein, Henry Grinsfelder, and S. D. Bailey, "Comparison of Methods for Improving Wood," *Industrial and Engineering Chemistry*, Vol. 36, March, 1944, pp. 252–256.

A. G. H. Dietz and Henry Grinsfelder, "Behavior of Phenolic Resin Bonded Plywood Under Alternating Stresses," *Transactions*, Am. Soc. Mechanical Engrs., Vol. 66, May, 1944, pp. 319–328.

DISCUSSION

Mr. Eugene W. Greenfield.[1]—I should like to ask whether there is anything particular about the bonding process. I am interested in the question of whether high frequency dielectric heating was used in bonding the laminations together.

Mr. Henry Grinsfelder.[2]—No, these were all bonded in a steam-heated hydraulic press. There was no high frequency used or anything like that in this particular phase of the work.

One panel was bonded at the high temperature of 350 F. This panel was prepared for two reasons, and one of them is pertinent to your query. The high temperature of 350 F. was used primarily because temperatures in that range are expected to improve the dimensional stability of high density woods. That temperature was also considered for use, however, because occasionally high-frequency heaters develop local zones of energy concentration and in those zones temperatures of 350 F. or higher may be encountered.

[1] Anaconda Wire and Cable Co., Hastings-on-Hudson, N. Y.

[2] Senior Engineer, The Resinous Products & Chemical Co., Philadelphia, Pa.

A Numerical Rating Method for the Routine Metallographic Examination of Commercial Magnesium Alloys*

By P. F. George[1]

SYNOPSIS

With the rapid increase in the metallographic work on magnesium alloys and the difficulty of obtaining trained metallographers, it became necessary to develop a method for routine examination of these alloys, whereby inexperienced persons could record a microstructure.

Such a method is described here and includes the specimen preparation, etching technique, and a rating system for recording the microstructure as a series of numbers.

Preparation of Specimens

Magnesium and its alloys polish very rapidly. They are therefore easily scratched and the surface layer can be readily cold-worked. A method for polishing these alloys which has been used successfully is given here.[2,3]

Small or hard-to-hold specimens can be first mounted in Bakelite, Styron or Lucite. Sulfur can be used if a mounting press is not available but is not so satisfactory as the plastic mounts because of its chipping and fouling of the wheels. Woods metal or other metallic mounts should never be used for the magnesium alloys because of the galvanic effect during washing and etching.

The grinding is done on aloxite cloths Nos. 50, 150, and 320 and emery paper No. 0. The aloxite cloths and paper are mounted on disks rotating over oil tanks as shown in Fig. 1. The oil catches the dust, keeping it from the operator's face and also preventing any fire hazard from an accumulation of the fine magnesium dust. A coarse screen below the surface of the oil serves to catch any specimens that are accidentally dropped into the oil. The dust sludge is drained periodically from the tanks. All grinding operations are prolonged somewhat beyond the time required to remove the preceding scratches in order to remove the cold worked layer as well.

The polishing is carried out on two rotating wet laps, both being covered with "Vel Chamee" cloth.[4] A distilled water suspension of 600 alundum is used on the first wheel. The speed of this wheel is from 400 to 600 rpm. The cloth is maintained just moist enough to prevent seizure of the specimen. The specimen is rotated counter to the direction of the wheel until the scratches from the last emery paper have been removed and the specimen takes on a satin finish. Excessive polishing on this wheel gives undesirable relief of some of the harder constituents.

A suspension of relevigated alumina is used on the final polishing wheel. This can be prepared by thoroughly shaking a good grade of commercial levigated alumina with distilled water and then siphoning off the upper 2 in. of the supernatant suspension after allowing it to stand for 3 hr. The sediment can be reworked several times to yield additional solution. Filtered soap solution is added to the above relevigated alumina suspension in the proportion of 20 ml. per liter. The speed of the final wheel can be from 100 to 400 rpm. and the specimen is rotated slowly counter to the direction of the wheel until a very high gloss is obtained. The specimen is rinsed in running water, then in alcohol and dried in a blast of air. The specimen is then ready for examination unetched or may be etched with a suitable etchant to reveal the microstructure.

Etching

The choice of etchants used for micro examination is based more on the physical condition of the alloys than on their composition. For sand-cast, permanent mold-cast or die-cast metal in the as-cast condition, and for all of the alloys in the aged condition, the "glycol" etchant is perhaps the best. It has the following composition:

Ethylene glycol	75 per cent by volume
Distilled water	24 per cent by volume
Concentrated nitric acid	1 per cent by volume

The freshly polished specimen is immersed face up in the etchant for 5 to 15 sec., washed well in running water, then in alcohol and dried in a blast of air.

To show grain boundaries in the solution-heat-treated castings and most of the wrought alloys, the "acetic-glycol" etchant is used. It is composed of:

Ethylene glycol	60 per cent by volume
Distilled water	19 per cent by volume
Glacial acetic acid	20 per cent by volume
Concentrated nitric acid	1 per cent by volume

For estimating the amount of massive compound in heat-treated castings or in wrought metal the "phospho-picral" etchant is used. This etchant stains the solid solution and leaves the compounds white. It consists of the following:

Orthophosphoric acid	0.7 ml.
Picric acid	4.0 g.
Ethyl alcohol (95 per cent)	100 ml.

The specimen is immersed in the etchant face up for about 10 to 20 sec. or until the polished surface is darkened. The specimen is then washed in alcohol and dried or it can be washed in alcohol, then in water, then alcohol again and dried. Washing directly in water will lighten the stain, and the contrast between the white compound

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the authors. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

* Presented at the Forty-seventh Annual Meeting, Am. Soc. Testing Mats., New York, N. Y., June 26–30, 1944.

[1] Metallurgist, Metallurgical Department, The Dow Chemical Co., Midland, Mich.

[2] J. B. Hess and P. F. George, "The Metallography of Commercial Alloys," *Transactions*, Am. Soc. Metals, Vol. 31, No. 2, p. 423 (1943).

[3] H. Vosskühler, "The Technology of Magnesium and Its Alloys," F. A. Hughes and Co., Abbey House London, N. W. 1, p. 37 (1940).

[4] "Vel Chamee" cloth can be obtained from John Ritzenthaler, 73 Franklin St., New York 13, N. Y.

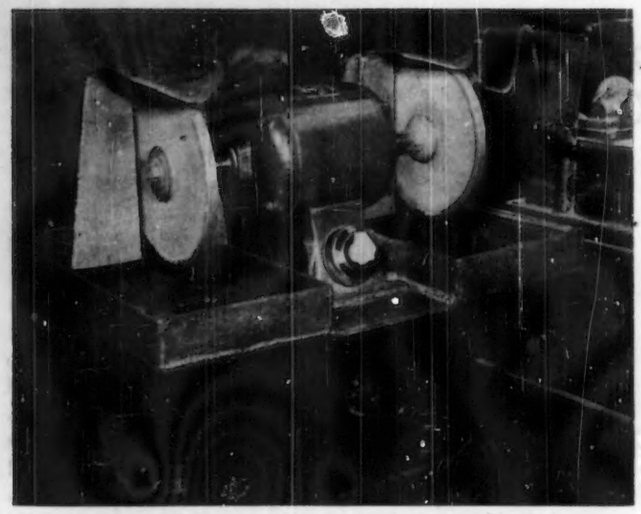


Fig. 1.—Grinding Wheels for Magnesium Alloys.
Oil tanks below grinding wheels catch the fine magnesium dust.

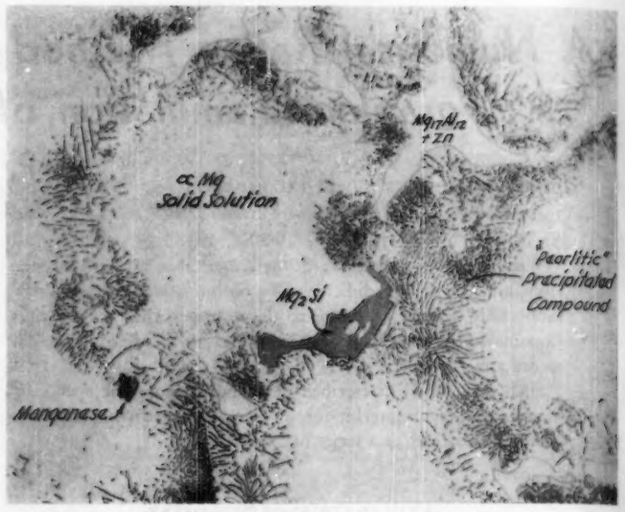


Fig. 2.—Sand-Cast Dowmetal C Alloy (Mg, 9 Al, 2 Zn, 0.1 Mn). Etched in "Glycol" (× 500) (Reduced one half in reproduction).
The massive compound $Mg_{17}Al_{12}$ + Zn, the pearlitic precipitated compound, αMg solid solution, a Mg_2Si particle and a manganese particle are all shown.

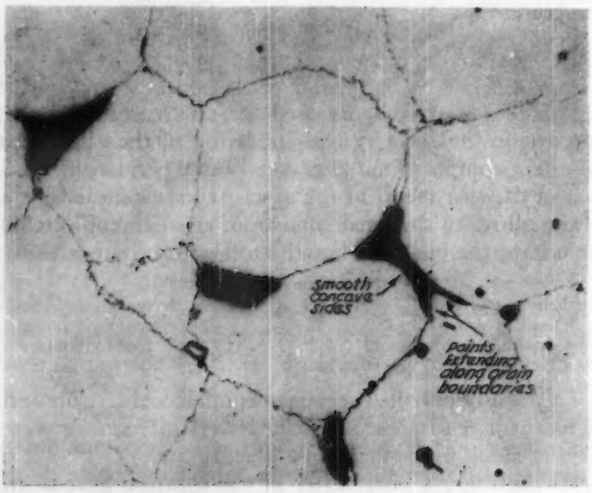


Fig. 3.—Shape of "Burning" Voids in Improperly Solution-Heat-Treated Cast Magnesium Alloy. Etched in "Glycol" (× 600). (Reduced one half in reproduction).

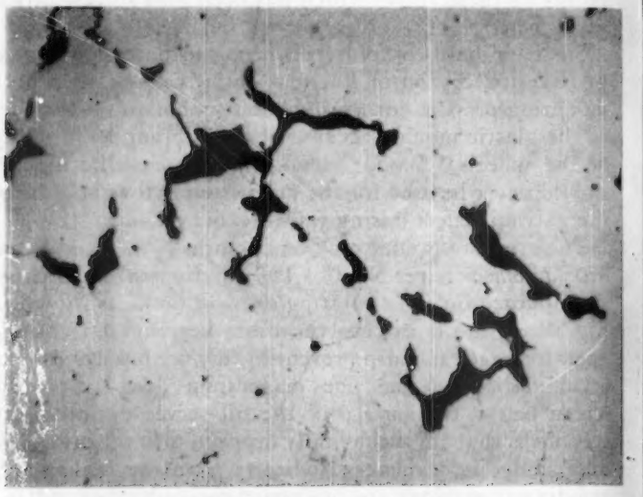


Fig. 4.—Shape of Microporosity in Cast Dowmetal H Alloy. Unetched (× 100).

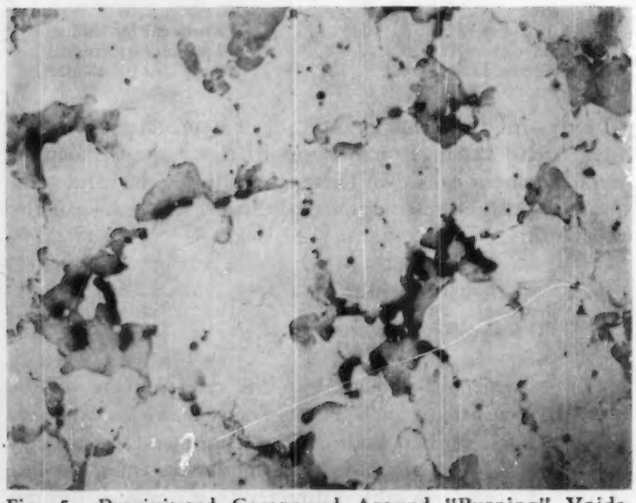


Fig. 5.—Precipitated Compound Around "Burning" Voids. Etched in "Glycol" (×100).

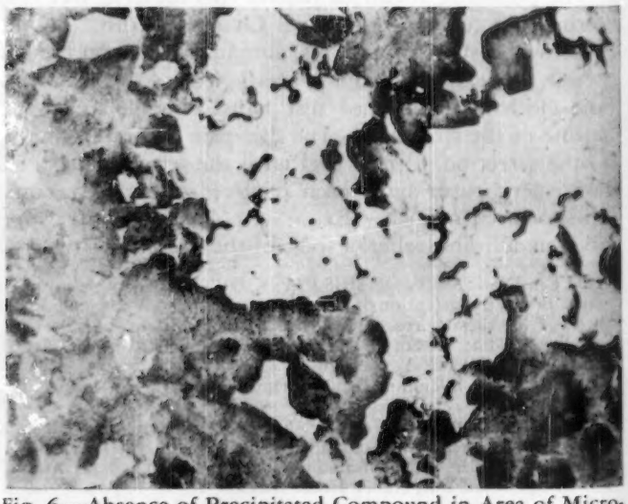
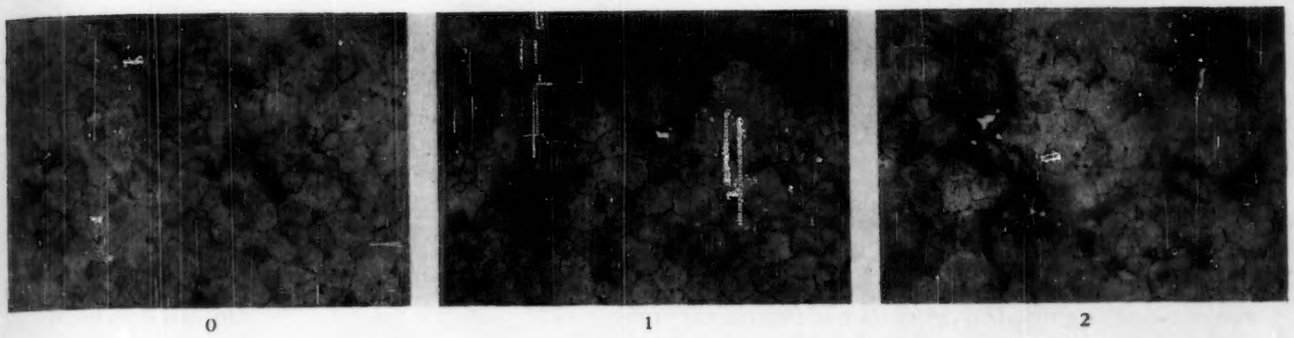
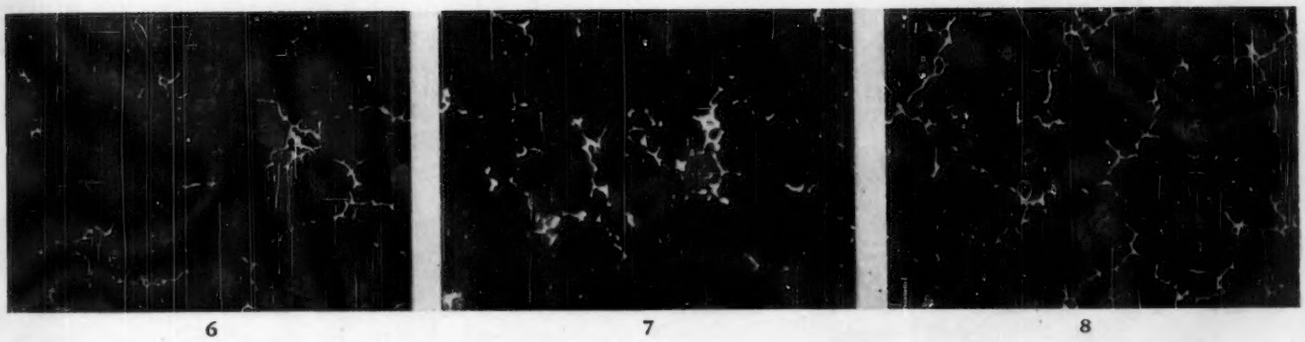


Fig. 6.—Absence of Precipitated Compound in Area of Microporosity. Etched in "Glycol" (× 100).

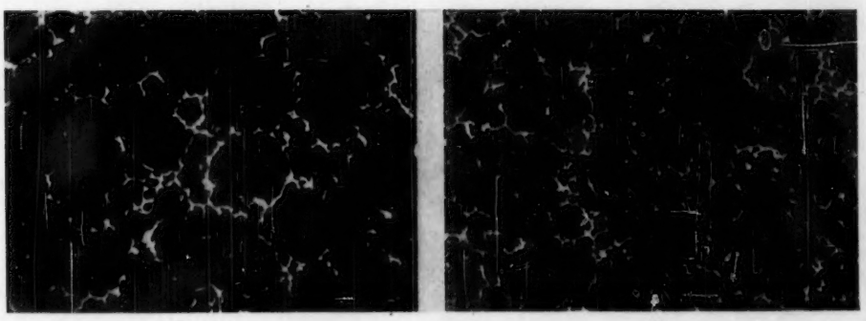


0 1 2

3 4 5



6 7 8



9 10

Fig. 7.—Rating Chart for Massive Compound in Cast Magnesium Alloys. Etched in "Phospho-picral." Original magnification, × 100 on 3 by 4-in. prints.

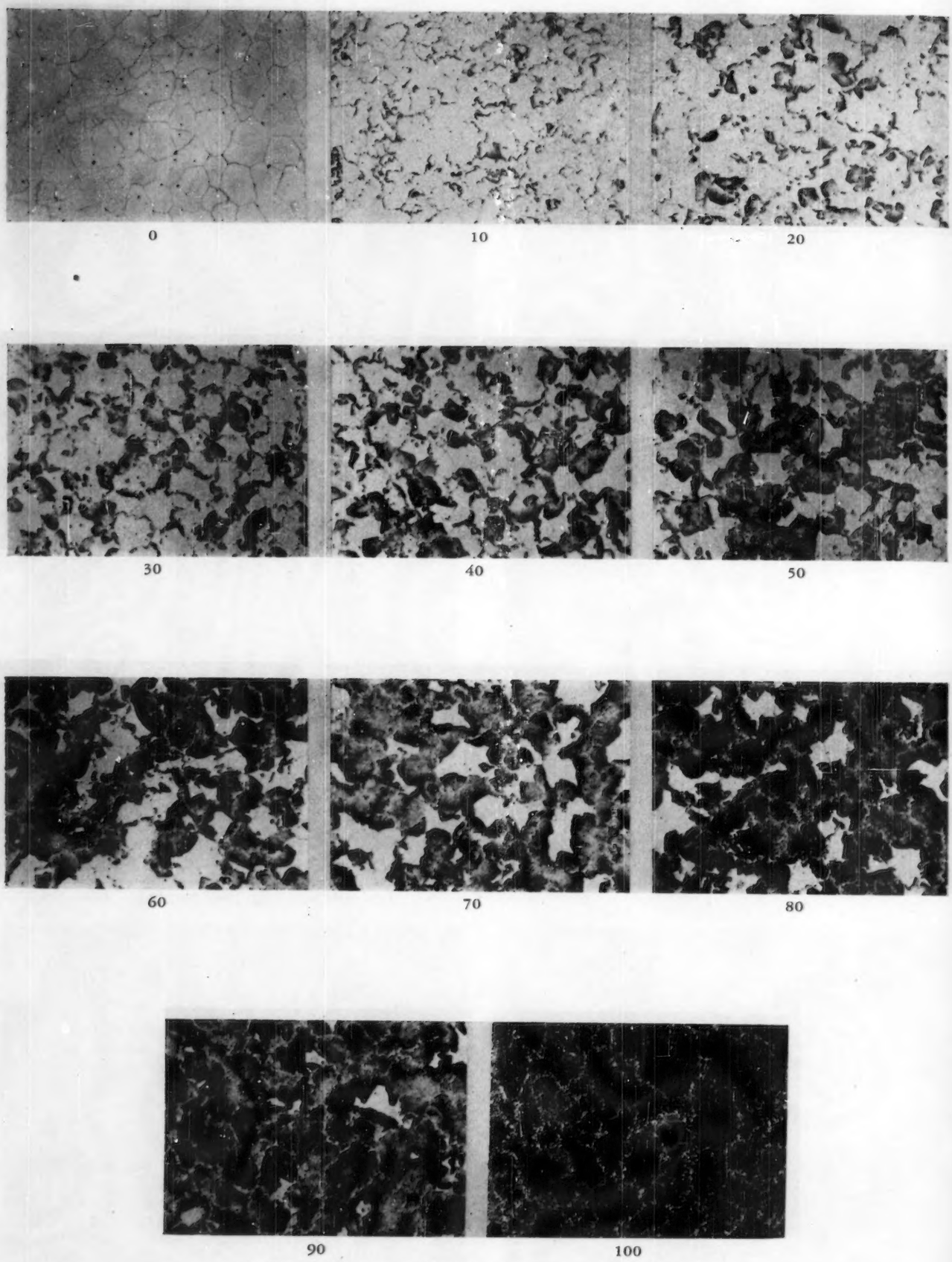


Fig. 8.—Rating Chart for "Pearlitic" Precipitate in Cast Magnesium Alloys. Etched in "Acetic-glycol." Original magnification, × 100 on 3 by 4-in. prints.

and the darkened solid solution will be lessened. This etchant improves with use.

For revealing the grain boundaries in the Dowmetal FS-1 (Mg, 3.0 Al, 1.0 Zn, 0.3 Mn)[5] alloy sheet the "acetic-picral" can be used. It also is excellent for macro grain size determinations as shown by Montgomery.[2] This etchant must be made up fresh each time it is used, but it can be prepared readily by mixing the two following solutions:

Saturated picric acid in 95 per cent ethanol.....	100 ml.
Glacial acetic acid.....	10 ml.

Examination of Microstructure

Before discussing the routine examination of the commercial magnesium alloys, a brief description of the microstructural features of these alloys is appropriate.

Aluminum.—Aluminum is the chief alloying constituent in the magnesium alloys. It forms an eutectic network consisting of the compound $Mg_{17}Al_{12}$ and the αMg solid solution.

Zinc.—Zinc, if present, is always added in conjunction with aluminum and has no effect on the identity of the phases present. It does, however, change the appearance of the eutectic, by making it a so-called "divorced" eutectic with the massive compound surrounded by the αMg phases. See Fig. 2.

In both the magnesium-aluminum and the magnesium-aluminum-zinc alloys, the compound may be precipitated from the solid solution to form a "pearlitic" type of precipitate at the grain boundaries (Fig. 2) or a fine Widmanstätten type within the grains as shown in Fig. 9.

Manganese.—Manganese is added to all commercal magnesium alloys to increase corrosion resistance to salt water. It appears in the microstructure as irregularly shaped bluish-gray primary crystals as shown in Fig. 2. The solubility of the manganese is greatly diminished in magnesium by the addition of aluminum. Therefore, more primary crystals can be seen in the magnesium-aluminum-manganese alloys, than in the magnesium-manganese alloys, even though the manganese content is much higher in the latter.

Silicon.—Silicon forms the Mg_2Si compound in the magnesium alloys. This compound can be distinguished from the manganese, by its brighter blue color, and by the fact that it polishes less in relief than the manganese. Figure 2 shows a Mg_2Si particle. The Mg_2Si has a "chinese script" appearance when the silicon exceeds 0.15 per cent.

Porosity and "Burning."—Microporosity (micro-shrinkage) and "burning" voids will be discussed together, because their appearance under the microscope is very similar. They both appear at voids at the grain boundaries. There are, however, some differences that sometimes help to reveal their identity. The voids produced by "burning" during improper heat treating tend to have smooth concave sides with sharp points extending along the grain boundaries as shown in Fig. 3, while those of microporosity tend to have an irregular outline as in Fig. 4. If the metal has been aged or if some aging has occurred during cooling from the heat-treating temperature, the areas containing microporosity will contain less precipitation than nonporous areas, while areas around "burning" voids will have the average amount of precipitate. Figure 5 shows the precipitated compound around "burning" voids and Fig. 6 the absence of precipitate in the region of microporosity.

The chief structural features in the commercial magnesium alloys to be studied under the microscope are therefore the massive $Mg_{17}Al_{12}$ compound, the precipitated compound, microporosity, "burning" voids, grain size, manganese, and the silicon compound.

The amount of massive $Mg_{17}Al_{12}$ compound can be rated by etching the polished specimen with the "phospho-picral" etchant as described above and projecting the average microstructure on a 3 by 4-in. rectangle on the screen of the microscope at 100 magnifications. The image is compared with the photomicrographs in the compound rating chart shown in Fig. 7. The number below the photomicrograph that has approximately the same area of compound as the reflected image will be the compound rating. This chart is based on the as-sand-cast Dowmetal C alloy (Mg, 9 Al, 2 Zn, 0.1 Mn) having a rating of 10 and a perfectly heat-treated Dowmetal C alloy with no massive compound present having a rating of 0. The intermediate photomicrographs have progressively more compound as the number increases. This chart is very useful for determining the quality of the solution heat treatment in all type cast magnesium alloys.

The amount of the "pearlitic" precipitated compound can be determined by the same method. The polished specimen is etched with either the "glycol" etchant or the "acetic-glycol" etchant and the microstructure compared with the chart of Fig. 8. The glycol etchants can be used after the "phospho-picral" etchant without repolishing. The precipitation chart is based on the percentage of area affected by the precipitation as seen under the microscope.

The type of precipitation is also reported. The "pearlitic" form, as type A, and the fine Widmanstätten, as type B, as shown in Fig. 9. The Widmanstätten type of precipitation is very difficult to rate and usually its presence is noted only.

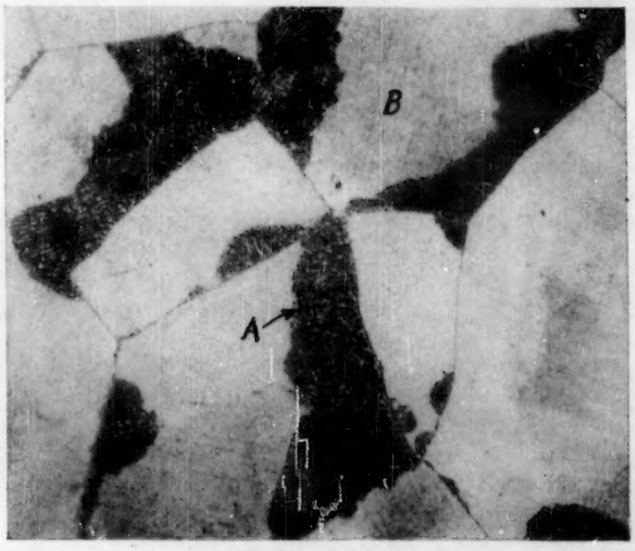
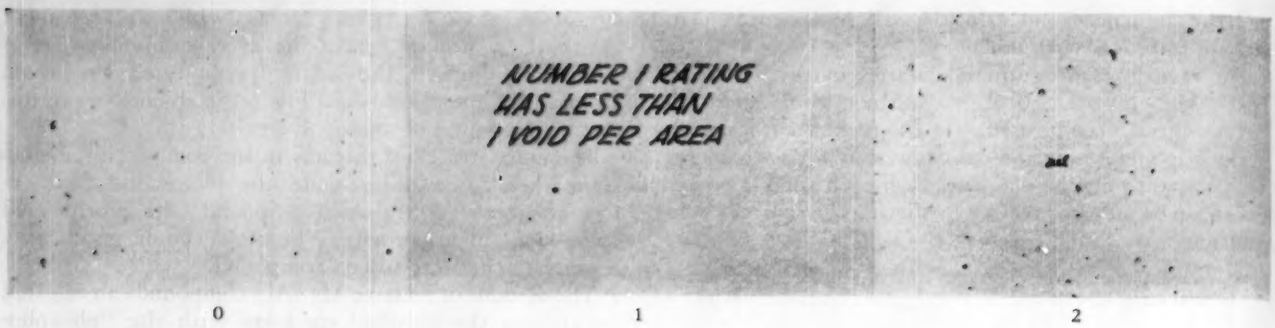
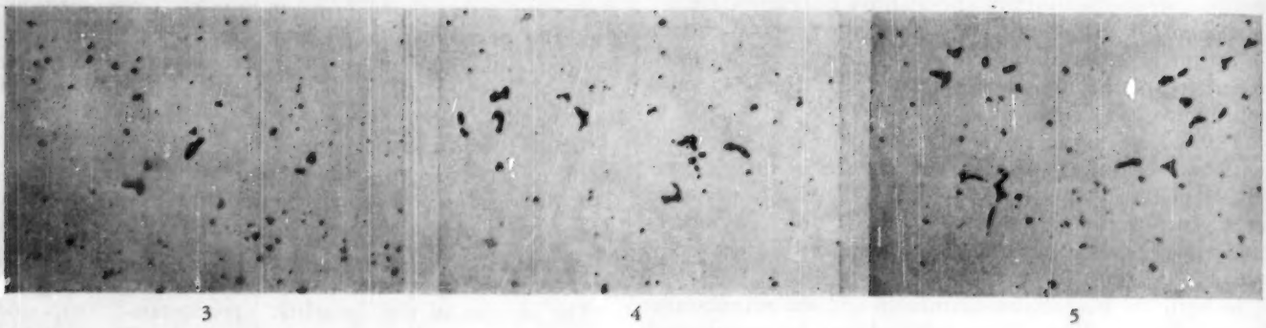


Fig. 9.—Types of Precipitate.
Etched in "glycol" (× 500).
A—"Pearlitic" type. *B*—Fine Widmanstätten type.

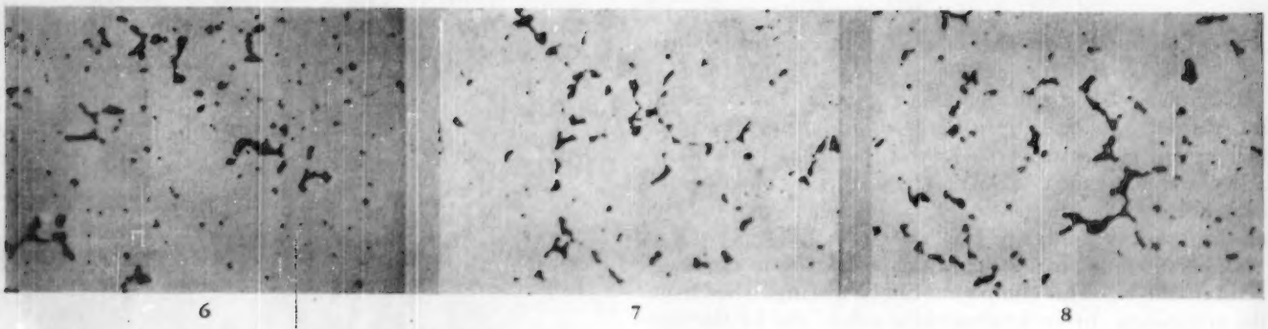
[5] Nominal composition in weight per cent. Magnesium represents the remainder, less impurity contents.



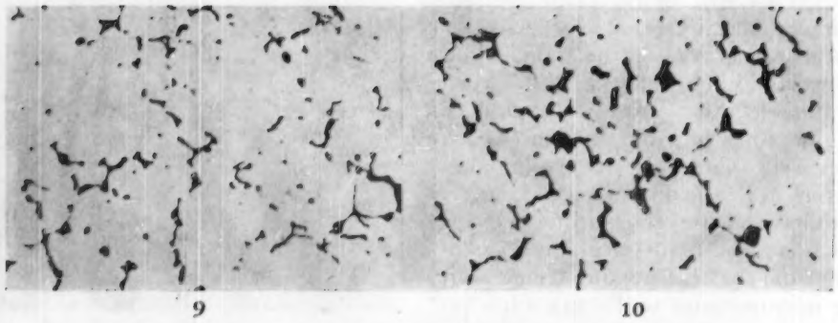
0 1 2



3 4 5

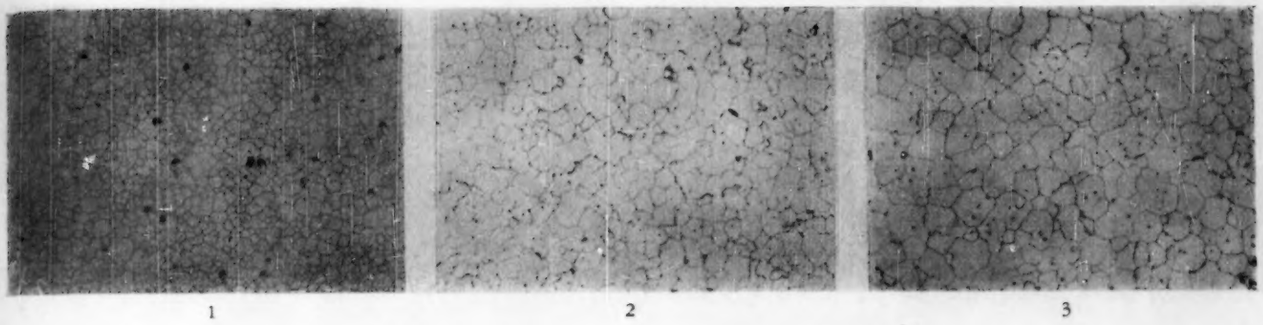


6 7 8

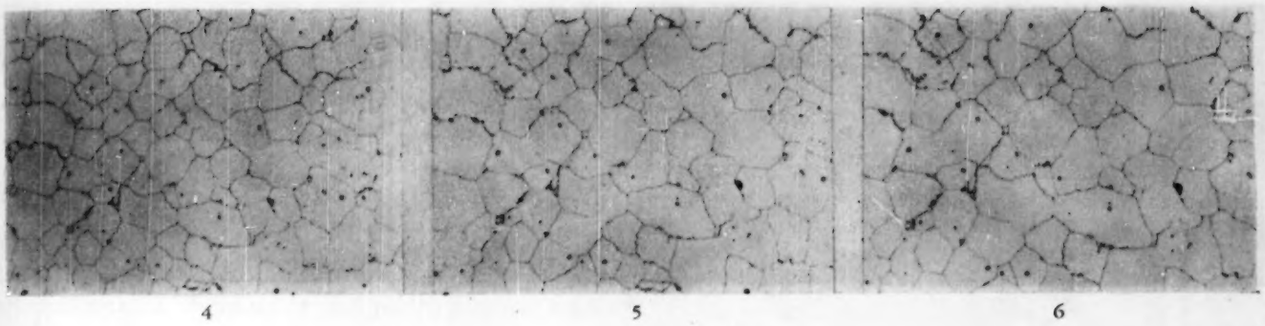


9 10

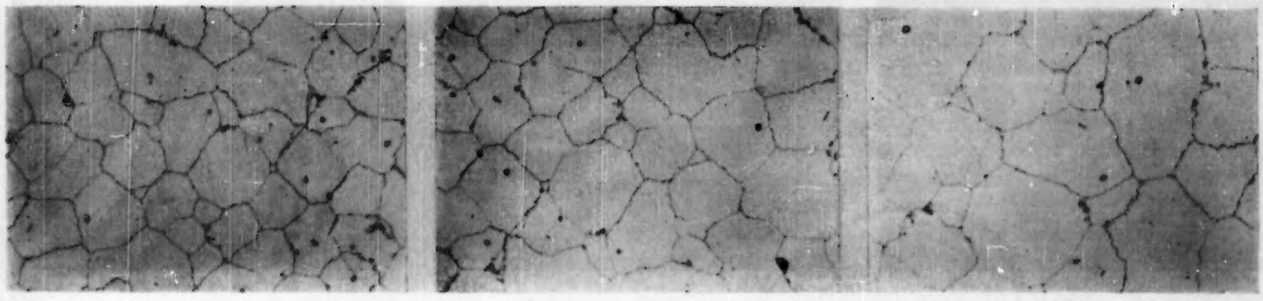
Fig. 10.--Rating Chart for Porosity and "Burning" in Cast Magnesium Alloys. Unetched. Original magnification, ×190 on 3 by 4-in. prints.



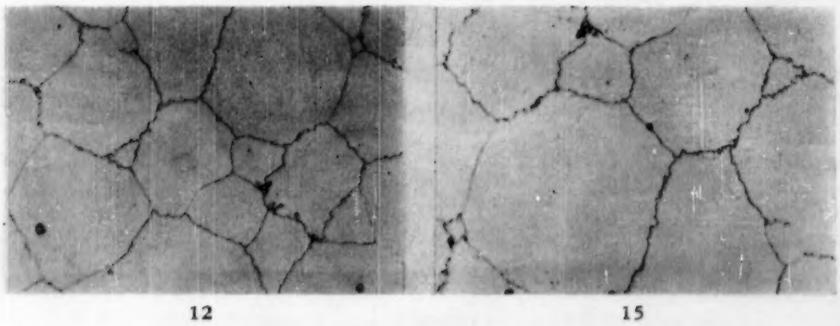
1 2 3



4 5 6



7 8 10



12 15

Fig. 11.—Grain Size Chart. Etched in "Acetic-glycol." Original magnification, ×100 on 3 by 4-in. prints. Grain size in thousandths of an inch.

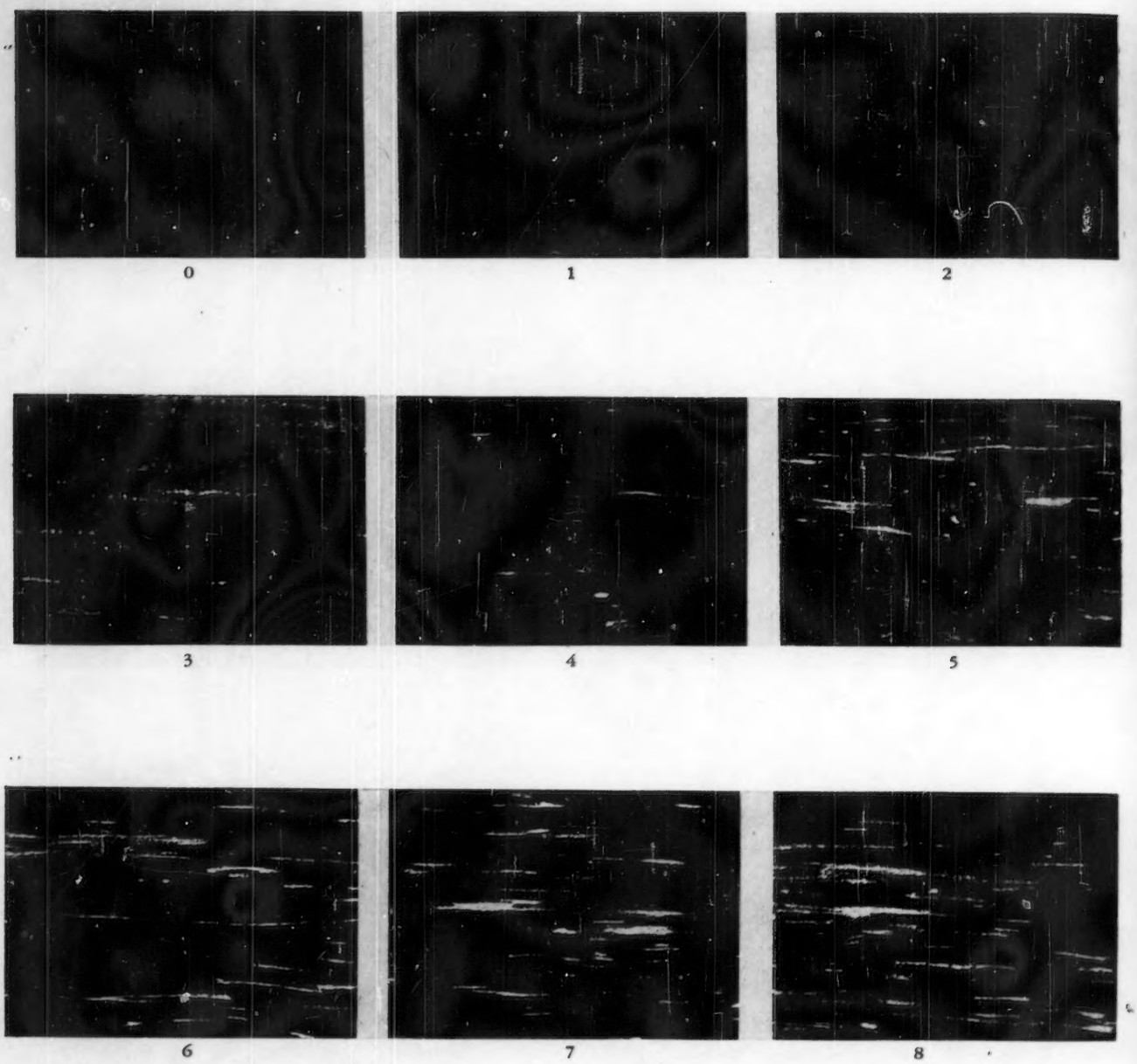


Fig. 12.—Rating Chart for Massive Compound in Wrought Magnesium Alloys. Etched in "Phospho-picral." Original magnification, × 100 on 3 by 4-in. prints.

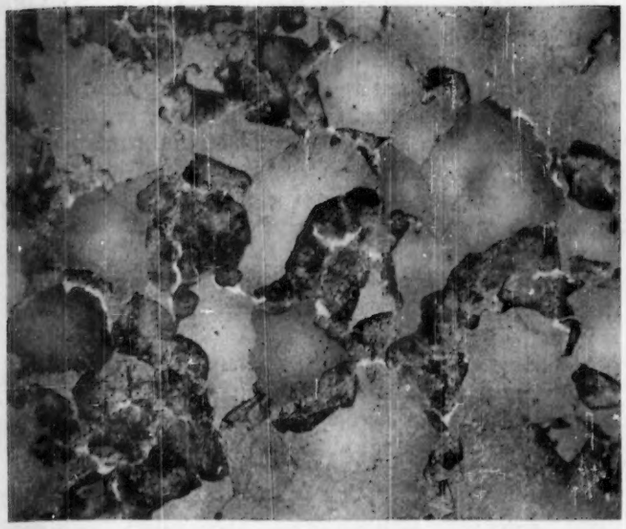


Fig. 13.—Example of a Structure of Sand-Cast and Heat-Treated Dowmetal C Showing Undissolved Massive Compound, Precipitated Compound and Grain Size. Etched in "Phospho-picral." (× 100).

The porosity and "burning" can be rated on the same chart shown in Fig. 10. This rating should be taken on the unetched or very slightly etched specimen so that darkened areas of precipitation will not be confused with porosity. A good average porosity rating is difficult to obtain because it is seldom evenly distributed. A maximum rating in addition to the average rating gives a better picture of the distribution of the porosity.

The grain size can be obtained by any of the usual methods or can be estimated by comparison with a grain size chart shown in Fig. 11. This comparison method makes it possible for rapid grain size determinations. It will be noted that whole numbers are substituted for thousandths of an inch. This method of recording grain sizes is suggested as a convenient and easily interpreted system for magnesium-base alloys.

The manganese and silicon phases are seldom reported in the microstructure unless they are unusually high or unevenly distributed.

The microstructures of the wrought magnesium alloys can be reported by similar methods. For example, Fig. 12 shows a compound rating chart for use with extruded, forged or rolled metal.

As an example of reporting the microstructure as a series of numbers, the following is a report of the structure of the solution-heat-treated casting shown in Fig. 13.

Compound rating	5
Precipitate rating	25
Type of precipitate	A
Porosity	0
"Burning"	0
Grain size	7

DISCUSSION

MR. WALTER BONSACK[1].—I should like to congratulate the author on a very fine job. I realize, too, that it is a difficult job to set up a rating for cast alloys, especially magnesium alloys. I have only a few remarks.

The choice of photomicrographs showing the differentiation between microporosity and a burned structure (Figs. 3 and 4) is somewhat misleading. Figure 3 is given at 600 and Fig. 4 at 100 magnifications. Figures 5 and 6 give a much clearer picture and probably represent a much better proof for the differences and, therefore, I would rather recommend the use of these photomicrographs.

Of course, in that case you could only determine whether the structure was burned by giving the material the aging treatment to bring out the precipitate around the pits.

It might be helpful, too, to consider X-ray in connection with microporosity and burning. Microporosity in magnesium cast alloys is usually concentrated in certain areas and is very easily found by X-ray examination and burning probably spreads over larger areas, particularly throughout the thin areas but more uniformly in concentration than microshrinkage. Therefore, I believe that X-ray investigation should complement the microscopic studies of the structure.

The rating chart for the massive compound is very excellent and so is the rating chart for the "pearlitic" precipitate in cast magnesium alloys.

I should like to ask the author whether there is any definite change in properties due to the presence of the "pearlitic" type of precipitate and a combination of both the "pearlitic" type and the fine Widmanstätten type precipitate. Has the latter type been observed without the presence of the "pearlitic"? If the "pearlitic" type is the prevailing one, is there any difference in properties or if there is a proportion of, say, fifty-fifty of Widmanstätten and "pearlitic," does it make any difference in the final properties?

The rating chart for porosity I would use with caution, as I pointed out. Porosity in magnesium alloys is hard to average. We have large areas which are perfectly sound. We have very small or sometimes large areas which are not so sound, but usually microporosity is very concentrated. It is a rather difficult job to determine which is the area of highest porosity and which is the average. I would not attempt to do it. And what bearing would it have if you actually did it? If you talk only about test bars, then you might have a reason for it if you determine the porosity in the test section of the test bar, the fracture area. But in casting as such, I would not dare to use this chart or even make any interpretation about a rating of porosity, since the porosity usually occurs in a few concentrated areas.

The grain size chart, Fig. 11, is very nice and, I believe, would come in very handy for routine work, for rapid work, although here again it seems to be a matter of sampling. It is unfortunate that castings have not as uniform a grain size as wrought materials usually have. From experience with aluminum and magnesium alloys, you find differences in grain sizes in various areas which might run anywhere from No. 1 to No. 15 in the same casting. It is a matter of selecting the average grain size, which probably can be established after you have had

[1] Chief Metallurgist, In Charge of Research Labs., The National Smelting Co., Cleveland, Ohio.

enough experience with one particular casting, but it has to be set up probably for each type of casting.

In general, I should like to congratulate the author for a very nice job.

MR. L. W. BALL[2].—The condition referred to by the author as microporosity is, as Mr. Bonsack mentioned, very clearly revealed on radiographs. The term most commonly used by radiographers to describe this grain boundary condition is "microshrinkage." This latter term is included in the Proposed Recommended A.S.T.M. Industrial Radiographic Terminology.[3]

The author's work is related to an attempt that we are making to relate the amount of grain boundary cavity with both the strength and with the radiographic appearance of coupons from magnesium castings. We have been using the X-ray micrograph technique to establish a quality rating chart which is showing a range quite similar to that shown by the author.

As a radiographic interpreter, I wish to thank Mr. George for a contribution which is of considerable value in one of our quality standards problems.

MR. R. L. HEATH[4] (*by letter*).—The methods presented in this paper are of considerable interest and value to the users of magnesium alloy castings. The Dow Chemical Co. thus assumes a leadership in the industry in presenting better methods for the evaluation and control of quality and mechanical properties of magnesium alloys. The work prepared here by Mr. George has been well done.

We and others in the aircraft engine industry are particularly interested in the grain size chart. While specifications limiting the grain size in magnesium alloys have not been adopted as yet by any recognized technical society, there is a definite need for such a requirement for the purpose of controlling the physical properties of magnesium alloy castings. The present specifications have tensile properties so low that considerable variation in handling of the metal in the foundry can occur. There is no practical way to raise the specification for separately cast test bars to exercise this control, so a grain size requirement is the best approach to this problem.

Figure 7 showing a rating chart for massive compound in cast magnesium alloys also can be useful to the user of castings. One of the most common defects in solution-treated cast magnesium alloys is the presence of continuous planes of soluble constituent after the solution treatment. We believe the time for solution treatment should be increased as the presence of appreciable amounts of undissolved constituent makes the material weaker and more brittle.

Metallographic studies are an important part of our metallurgical procedure for evaluating the properties of magnesium castings and we welcome this paper which adds to our technological understanding of magnesium alloys.

MR. P. F. GEORGE (*author's closure*).[5]—The photomicrograph of the burning voids in Fig. 3 was taken at a higher magnification to show the shape of the voids to a better advantage. Both the shape of the voids and the distribution of the precipitate should be considered in determining the difference between burning voids and microporosity, but as Mr. Bonsack points out, the latter is the best single method.

There is probably no better method for determining porosity in the commercial castings than by radiography. The microscopic method is used for definite sections and not as a method for rating an entire casting. We have found that the fine Widmanstätten type of precipitate as found within the grains gives more strength than the "pearlitic" type on the grain boundary. The fine Widmanstätten type of precipitate has never been found in the "pearlitic" area. Both types are easily resolvable with the electron microscope. Magnesium castings vary in grain size from grain to grain, but the difference in the average grain size between thick and thin sections is small.

[2] Assistant Technical Director, Triplett & Barton, Inc., Burbank, Calif.

[3] 1943 Symposium on Radiography, Am. Soc. Testing Mats., p. 251. (Symposium issued as separate publication.)

[4] Chief Metallurgist, Allison Division, General Motors Corp., Indianapolis, Ind.

[5] Metallurgist, Metallurgical Department, The Dow Chemical Co., Midland, Mich.

Recomparison of Length Standards

PRECISENESS and accuracy are very frequently stressed in connection with investigations of properties of materials, and because of this many will be interested in recent measurements made on the length standards at the National Bureau of Standards. An excerpt from the June, 1944, issue of the *Bureau's Technical News Bulletin* follows.

Recently, Benjamin L. Page of the length section redetermined the total lengths of two of the Bureau's invar laboratory meter bars—Meter 39 and Meter 752. He found that the former is still lengthening after 41 years of use at the Bureau, whereas the latter continues to shorten, as it has done ever since it was received in 1931. Platinum-iridium Meter 4 (a bar made of an earlier alloy, but having approximately the same composition as the National Standard, Meter 27) was used as the basis of the standardization, each of the laboratory standards having been compared with this platinum-iridium bar. Meter 39 and Meter 752 were then compared directly, and agreement to 0.01 micron (approximately four one-hundred-thousandths of an inch) was found with the computed difference in length.

This gives renewed assurance of the accuracy of all the Bureau's work.

Highway Research Board Proceedings

VOLUME 23 of the Highway Research Board Proceedings, a cloth bound publication of about 600 pages, covering the numerous items presented at the November, 1943, meeting is available, and can be purchased from the Board, 2101 Constitution Avenue, Washington 25, D. C., at $3.50 per copy. There are a large number of contributions covering design, materials and construction, maintenance, traffic and operations, soils, aerial photography, etc.

The latest issue of *Roadside Development Reports* in bound mimeographed form will also be ready shortly at a cost of $1.00.

Booklet on Wear

MEMBERS and BULLETIN readers who are interested can obtain without charge from the Nitralloy Corp., 230 Park Avenue, New York, N. Y., a copy of their 46-page booklet entitled "Wear," a discussion of the mechanism of wear phenomena and influencing factors. In the booklet there is material on mechanism; molecular adhesion; surface melting; lubricants; galling; scoring; and work hardening.

Quantitative Spectrographic Analysis of Copper Alloys[1]

By R. A. Wolfe[2] and Emile J. Jemal[3]

SYNOPSIS

A method is given for the routine spectrographic analysis of copper alloys. A large part of the elements determined are at the 10 per cent level, but an occasional analysis is made with contents as high as 25 per cent. Spectrographic sources are discussed and a new-type spark source suggested. Various details of the problem, such as errors due to sampling and corrections on the analyses due to interfering substances, are considered. Examples of working curves are included. It has been shown that during actual routine plant control, errors of analysis should not exceed ±1.5 per cent of the amount of the element present.

At the present time many industrial laboratories are using the spectrograph as a tool for making accurate and rapid analyses of metals for control purposes. In the main, such analyses have been restricted to elements present only as traces or to alloying constituents with a concentration of under 5 per cent. Spectrographers have long felt, however, that, with suitable equipment and careful consideration of fundamental procedures, the methods could be extended to much greater concentrations. With spectrographic procedures, it must be remembered that the accuracy obtained is largely a constant percentage variation of the amount of the unknown present. For low concentrations even a considerable percentage error can be tolerated because the absolute error falls below the allowable limits. With copper alloys, however, most of the unknown elements are above the 5 per cent limit, and thus great care must be exercised to obtain the highest possible precision in all factors involved in order that the absolute error shall remain below the limit of tolerance. To make the spectrograph applicable to many important problems in industry involving the analysis of alloys for constituents occurring in considerable percentages, it must be shown that it can compete both in accuracy and speed, with accepted chemical procedures now in use.

We believe that we have now demonstrated the full practicability of such methods with copper alloys having wide variations in composition. There were many difficulties. Some constituents of the alloys to be controlled ran as high as 25 per cent by weight, while many of the most common elements were around the 10 per cent level. Some of the alloying constituents did not form solid solutions with the copper matrix but were dispersed more or less uniformly in the form of tiny grains or inclusions. Certain classes of alloys may have wide differences in the amounts of the alloying constituents as, for example, lead, which may vary from 1 to 25 per cent, while at the same time the percentages of other alloying constituents also change considerably. Because of these large variations in composition, it would be necessary to determine a large family of analytical curves since one element may influence the analysis of another. As may readily be seen, this would necessitate an extremely large number of standard samples and a great deal of time in actually preparing the curves. Correction factors were, therefore, worked out to cover an extended analytical range. Analytical speed is necessary, and the analyses must be at least as good as the accepted chemical results. These problems and many others have been successfully worked out, and at the present time spectrographic methods are being used for foundry control of many copper alloys. Details of various phases of investigation follow.

Spectrographic Technique

During the initial stages of the investigation, several standard methods of spectrographic procedures were tried. Among the sources used may be mentioned the d-c. arc, the a-c. arc, and various types of controlled spark sources. Since it was necessary to analyze the alloys for elements at high concentration, it quickly became evident that only some type of a rigorously controlled spark source would give the necessary analytical precision. Our experimental apparatus permitted wide variations in spark excitation, and the limits for workable conditions were rapidly established.

Some spectrographic installations for non-ferrous metals use a spectrograph of medium dispersion. We have found that better results are secured by using a spectrograph of large dispersion. Accordingly, a large Littrow spectrograph was used. A microphotometer of good reliability is an absolute necessity. For accurate measurements with a microphotometer, the spectral lines must have sufficient area to guarantee that small changes in plate characteristic, dust particles, etc., will not have a material effect on the results. Likewise, the microphotometer should be free from scattered light. Variations were introduced into the conventional spark source, but the remainder of the equipment was more or less standard.

In most cases, with copper alloys, it is impossible to find suitable copper lines very close in wave length to the unknown element lines. For this reason, it was necessary to use a photographic plate having a constant contrast over a wide range of wave lengths. A high contrast plate was also desirable, and, after testing a large number of plate types, Cramer's contrast plates were selected. These plates have been in use for production control for about a year and are satisfactory.

Plates have been calibrated with a step diaphragm, a rotating step sector, and iron lines of known relative intensities. While all three methods are open to some objections, the calibration with iron lines proved most reliable and is being used. Excitation conditions, exposures, and plate development are carefully controlled, and usually very little shift in the characteristics of the photographed spectrum takes place from day to day. As a rule, it is only necessary to check three or four points on the characteristic curve for each plate to keep complete control of working conditions. Of course, for work requiring such a

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] Presented at the Forty-seventh Annual Meeting, Am. Soc. Testing Mats., New York, N. Y., June 26 to 30, 1944.

[2] Research Physicist, Department of Engineering Research, University of Michigan, Ann Arbor, Mich.

[3] Federal-Mogul Corp., Detroit, Mich.

high degree of precision, only the straight-line portion of the characteristic *H* and *D* curve may be used.

Spark Source

Two types of spark sources were used for this investigation. One was a standard high voltage source with synchronous rotating spark gap in series with the analytical spark gap, and the other a high voltage spark with an auxiliary air gap. Details of the first type of spark source are well known, but since the second type source is less widely known, a more complete description of it will be given.

The apparatus used for the second type source is a modification of the controlled spark circuit, using instead of a synchronous rotating auxiliary spark gap an auxiliary air gap in which the air dielectric is restored between sparks by an air jet which sweeps away the ions produced by the spark.

The transformer is a 5 kva., 220-v.-35,000-v. distribution transformer. The input current is limited by resistance in the primary to about 10 amp., which gives a good margin of safety on the condensers employed. Less energy should not be attained by increasing the primary resistance, since this only reduces the secondary voltage of the transformer and leads to erratic sparking. Control should be made by varying capacitance and damping resistances in the secondary circuit. For most of the work described later no damping resistances were used.

The auxiliary gap is made of two $^1/_4$-in. tungsten rods spaced 4 mm. apart. Air from a jet of slightly larger aperture is blown through this gap. It is imperative that the velocity of the jet be high. A 15-lb. pressure at the jet is usually used. Best results are obtained when there is a smooth and steady train of sparks.

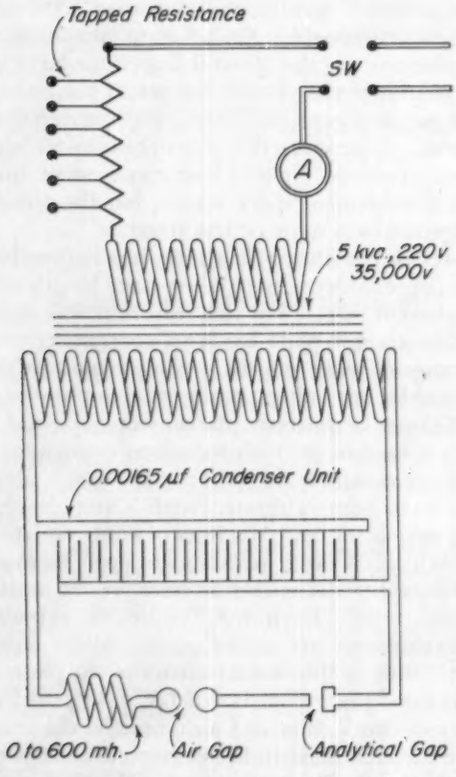


Fig. 1.—Wiring Diagram of Spark Unit.

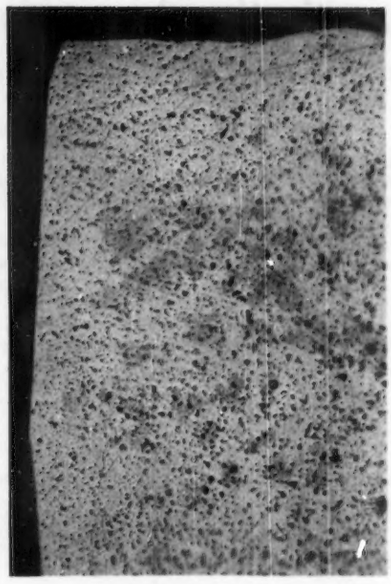


Fig. 2.—Photomicrograph of Copper-Lead Alloy Showing Lead Inclusions.

Figure 1 gives the details of the circuit. For copper alloys we normally use three condensers having a total capacitance of 0.00495 μf and an inductance coil of about ten turns having an inductance of 100 μh. These constants give a high frequency in the oscillating circuit. When this circuit is used, it is observed that the successive sparks are well distributed over the ends of the electrodes in the analytical gap. From three to five sparks per cycle occur when the capacitance and inductance have the values given.

Sampling

With copper alloys, sampling difficulties are considerable. While with most iron alloys complete solution takes place between the alloying constituents and the iron, with some copper alloys, particularly those containing lead, this is not the case. The resulting alloy is a mixture with the lead distributed more or less uniformly throughout the product. Because of this, great care must be exercised in getting a uniform, representative surface for the spark to work on. Figure 2 is a photomicrograph of an alloy containing lead which shows the type of lead inclusions referred to.

Many methods of sampling were tried. At first, $^1/_2$-in. bars about 6 in. long were sand cast. The bars were then machined down to rods $^1/_4$ in. in diameter. The electrodes thus formed were uniform and the results reproducible. It was soon found, however, that the results, although uniform, were not representative of the entire melt. In most cases, the measured values of the percentages of the alloying constituents were too low. Further study revealed that the rods were nonuniform in composition and that the portion machined off in the preparation of the small electrodes had a different composition than the remainder of the bar. This in itself would not have been serious, but it was later found that the degree of

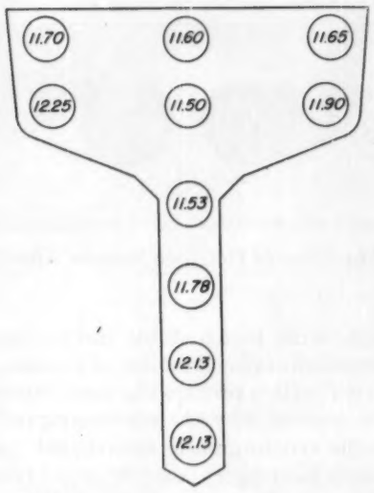


Fig. 3.—Variations in Percentage Tin at Various Points in a Standard Specimen.

segregation of elements in the bar was influenced by the rate of cooling. Since control of the cooling rate and of the pouring temperature was rather difficult, this method of sampling was quickly abandoned.

Large steel molds were then designed to give pins $^1/_4$ by $1^1/_4$ in. under a large hot top. If the pins were broken off close to the hot top and sparked at this end, fairly consistent results were obtained. Later, it was discovered that the size of the hot top influenced the results, especially in the case of lead. Best results were obtained by this method when very little hot top was left in the mold. Next, pairs of electrodes were made by discarding $^1/_4$ in. of the tip of the pins opposite the hot top and sparking the two surfaces thus formed. This gave uniform results.

Many attempts were made to take samples by sand castings. The pins were well formed and easily made in the foundry. Erratic results were observed, however, and the reason was carefully studied. Figure 3 shows a sand casting cut lengthwise through the pins and hot top. Using this piece for a lower electrode and a pure copper rod for the upper electrode, spectrograms were taken to find the percentage composition at the points shown. The pattern shown is typical, and considerable variation in the composition of the alloy was found to exist from point to point. With sand castings, the rate of cooling is slower than with chill castings and this apparently allows segregation to take place. The spot yielding the lowest results and as a rule the least reliable, was found to be just where the sample pin joins the hot top. Presumably, this was the last part of the pin to cool. All such samples showed a greater concentration of some elements near the surface.

Since rapid cooling seemed desirable, the next samples were cast as small buttons about 1 in. across and $^1/_2$ in. thick. These were then cut through the small diameter and sparked as electrodes against pure copper. The results were erratic and inconsistent. Sparking to flat surfaces will be discussed later.

A combination of chill cast and sand cast technique was next tried. Sand molds were made having two or more $^1/_4$ by $1^1/_4$-in. slots on the bottom. These slots were then placed on top of a large, heavy, iron or copper plate. The metal was poured through the sand mold against the metal plate. The pins were then broken off and used as electrodes. Results were good, provided pouring temperatures were high enough and the mold carefully handled. Again the most consistent results were obtained with small hot tops.

Finally specimens were taken with glass tubes. Pyrex tubes $^9/_{32}$ in. in inside diameter were dipped into the molten alloy and quickly withdrawn. With care, excellent samples were secured which had remarkably good uniformity. Since, in most cases, however, it is difficult to take specimens in this fashion, the method was not adopted. The best sampling technique was found to be that employing the use of large metal molds and very little hot top.

Spectrographic Procedures

Careful consideration was given to the size and shape of the electrodes used. Pins were varied from $^1/_8$ in. to 1 in. in diameter. With the power used, 5 kva., the gap width tended to increase during sparking when the small $^1/_8$-in. pins were used because of the melting of the pins. With the larger pins, $^1/_2$ in. and over, only portions of the surface received ample presparking before the spectrograms were taken. Little difference was found for pins between $^5/_{32}$ in. and $^3/_8$ in.; consequently, $^1/_4$ in. was selected as a reasonable size.

Excitation conditions in the spark were varied until a complete and uniform surface condition existed after presparking. Too high capacitance or inductance, resulting in lower spark frequency, had a tendency to cause the spark to localize because of excessive heating. This condition would be serious if the surface being sparked showed the slightest tendency toward segregation.

The ends of the electrodes were prepared by grinding on a wheel of suitable composition and hardness. Flat surfaces were found to be most reproducible, the sharp edges being slightly rounded off.

Time of Wait Curves

To find when the electrodes had been run in the spark sufficiently long to reach a stable condition, time of wait curves were determined under various conditions. Examples of the curves obtained are shown in Fig. 4. These curves show the logarithm of the ratio of intensity of a pair of tin and copper lines known by previous results to be well

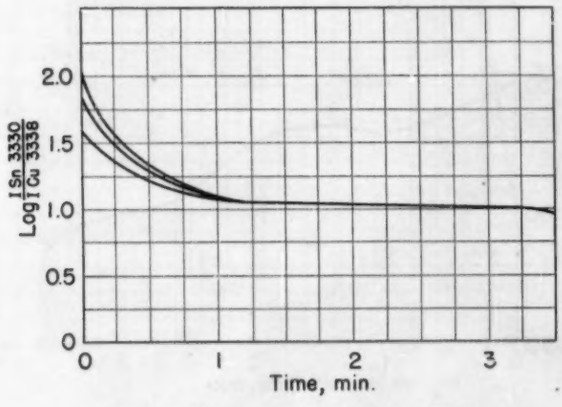


Fig. 4.—Time of Wait Curve for Tin.

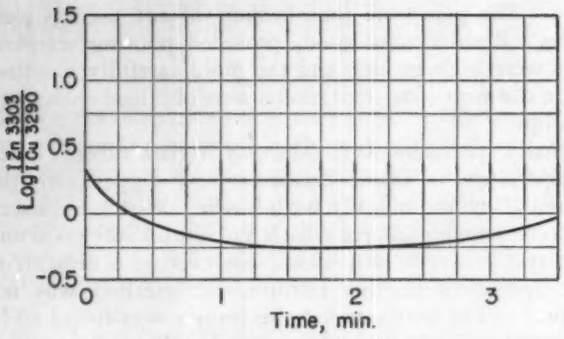


Fig. 5—Time of Wait Curve for Zinc.

suited to the purpose. From such curves it can be seen that a proper operating condition is reached after about $1^1/_2$ min. After this, for several minutes, little change takes place in the tin and copper ratio. Finally, however, the surface seems to begin depleting with respect to tin and the ratio falls.

The curves of Fig. 4 illustrate a condition frequently found in this type of spectrographic analysis. It will be noticed that the logarithms of the ratios of intensity of the tin and copper lines have different initial values. Moreover, the time of wait curves approach stability over different paths, and it would be impossible to obtain high accuracy at any point on the curves before true stability of surface occurred.

A pre-exposure time of $1^1/_2$ min. would then be selected for the tin determination, provided the other alloying constituents followed the same pattern. The curves shown in Fig. 4 were made from an alloy containing 88 per cent copper, 10 per cent tin, and 2 per cent zinc. Figure 5 shows a time of wait curve for zinc in the same electrodes. As will be noticed, surface stability occurs after about $1^1/_2$ min. of sparking, as before. However, a considerable difference is then noted in the remainder of the curve. After a few minutes of continued sparking, the zinc–copper ratio increases. This must be due to the fact that zinc oxide is formed on the surface and is depleted more slowly than the copper oxide. For this alloy, then, a presparking time of $1^1/_2$ min. would be selected.

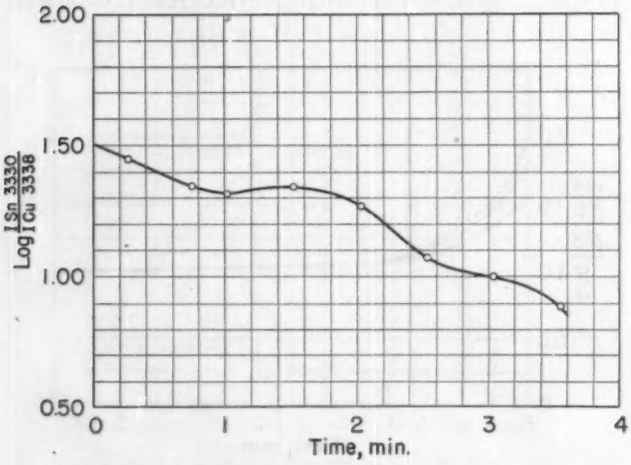
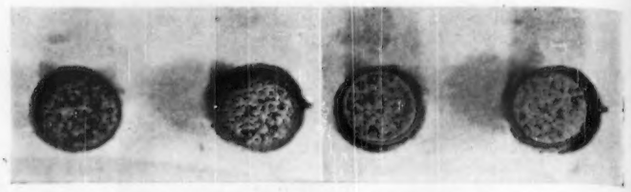


Fig. 6.—Time of Wait Curve for Flat Surface Sparking.



(*a*)—High inductance and capacitance. (*b*)—Low inductance and capacitance.

Fig. 7.—Condition of Electrode Surfaces After Sparking.

The rapidity with which stable surface conditions are reached is dependent upon a number of factors. The number of sparks per cycle is perhaps the most important. This is one of the reasons why the air-interrupted spark was chosen over the synchronously interrupted spark. With the synchronous interrupter, a much longer time of wait is required before a stable surface exists. With very small pins ($^1/_8$ in.) surface stability is quickly reached, but melting takes place soon after. With large surfaces ($^1/_2$ in. and above) the entire surface never becomes stable, and it is most difficult to reproduce conditions. With one large flat surface and one pure copper electrode, surface stability is lacking. When stability is reached in one small spot, the spark moves to an unsparked area and repeats the previous processes. This instability of surface is clearly shown in the time of wait curve of Fig. 6. After considerable sparking, almost any result can be obtained. For this reason, flat-surface sparking of copper alloys falls short of the desired accuracy.

Influence of Source Characteristics on Sample Preparation

Much can be learned about the uniformity of sampling by visual examination of the electrode surfaces after sparking. With high capacitance and inductance, the spark has a tendency to localize at one small spot on the electrode giving a false analysis due to high copper excitation. Moreover, for some alloys that have a tendency toward segregation in the grain boundaries, the spark will localize at the point of maximum impurity concentration. For best results the surface must be uniformly worked over during presparking so that when the record exposure is made, any area covered by the spark will show the same balance of elements. Figure 7 (*a*) shows two electrodes taken at high inductance and capacitance, and Fig. 7 (*b*) two electrodes taken at low inductance and capacitance. When the entire surface of both electrodes is covered with small droplets, as shown in Fig. 7 (*b*), excellent sampling is obtained.

Excessive heating also is detrimental because of oxide formation. As was indicated by the time of wait curve for zinc (Fig. 5), only a short interval of time is available to secure uniform results. With greater heating of the surfaces this period is considerably shortened and may, in fact, disappear completely.

Preparation of Analytical Curves

For simplicity, this discussion is limited to copper alloys with two variable constituents. A good example of this type of alloy is one with the composition 88 per cent cop-

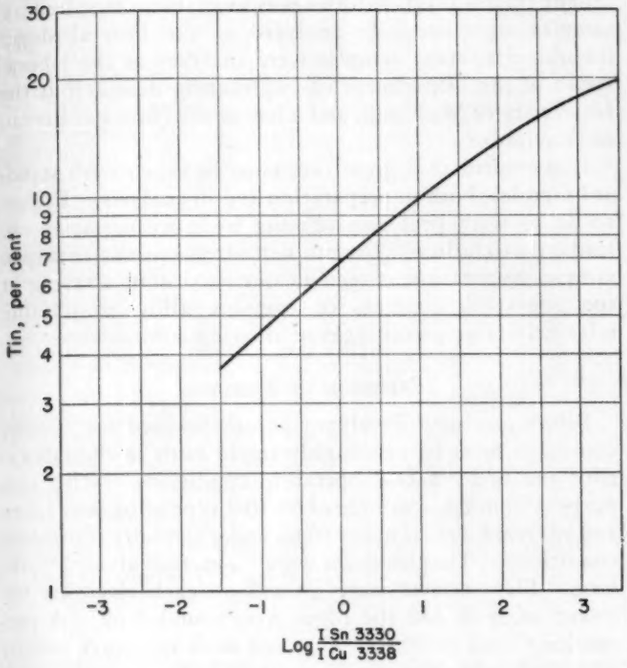


Fig. 8.—Working Curve for Tin in 88-10-2 Type Alloys with Zinc at 2.75 per cent.

per, 10 per cent tin, and 2 per cent zinc. This composition may vary a great deal, the tin ranging from 5 to 15 per cent and the zinc from 0.5 to 5 per cent.

Analyzed standards were first made with the zinc composition constant at 2.75 per cent. A suitable pair of tin and copper lines were selected having the correct density and as close together on the photographic plate as possible. Several spectrograms were taken of each standard sample with constant source conditions. The usual form of logarithmic ratio plot is shown in Fig. 8. It will be apparent at once from examining the figure that the graph is not a straight line as would normally be expected. The first reason for this departure might very well be the assumption that bending takes place because of the changing copper composition. If this is the case, a better graph would result from plotting the logarithm of the ratio of the tin concentration to the copper concentration against the usual logarithmic intensity ratios. This makes a slight improvement but is not the complete answer. A series of alloys was then made keeping the copper content constant and varying the tin and zinc concentrations. Results from these tests still failed to give a straight line.

Another possible cause of the abnormal bending in the analytical curve still remains to be discussed. The change in the composition of the alloy must affect the total amount of metallic vapors present in the spark gap. The voltage drop across the spark gap becomes lower and the ratio of tin atoms excited to copper atoms excited becomes greater as the total percentage of tin plus zinc becomes greater. If this latter explanation is correct, then changing either the tin or the zinc content with the copper remaining constant should produce the same general result. This is exactly what happens and it was found that no set analytical curve could be developed except when one unknown constituent was held constant. In other words, the apparent composition of the tin is affected by the zinc, and the zinc by the tin.[4]

In order to avoid having to make an extremely large number of analytical curves, based on a large number of possible alloy variations, a pair of correction curves for tin and zinc were worked out as shown in Fig. 9. The graph in Fig. 8 is based on alloys having 2.75 per cent zinc. It was then necessary to make a series of alloys with constant tin but varying zinc composition. This gave the tin variation curve of Fig. 9 which, of course, crosses the zero correction line at 2.75 per cent zinc. To determine the correction on the zinc due to the effect of changing the tin composition, a similar set of standards were made keeping the appropriate elements constant. This curve is shown in Fig. 9.

The procedure for analyzing unknowns now becomes apparent. Spectrograms are taken of any sample within the working range. The logarithms of the ratios of intensity of the selected tin, zinc, and copper lines are determined in the usual way. The apparent tin composition is read from a curve such as given in Fig. 8, and the apparent zinc composition from such a curve as shown in Fig. 10. Then, by referring to the curves in Fig. 9, the amount of correction can be read off and applied to the apparent composition to give the true composition.

When more than two variables are present, the procedure followed is the same, although somewhat more involved.

[4] The effect of the interdependence of the analysis of one element upon another has been noted by other workers. See Twyman and Hitchen, Proc. Roy. Soc. (London) A133, p. 72 (1931) and Duffendack, Wiley and Owens, Ind. Eng. Chem., Anal. Ed., Vol. 7, p. 40 (1935).

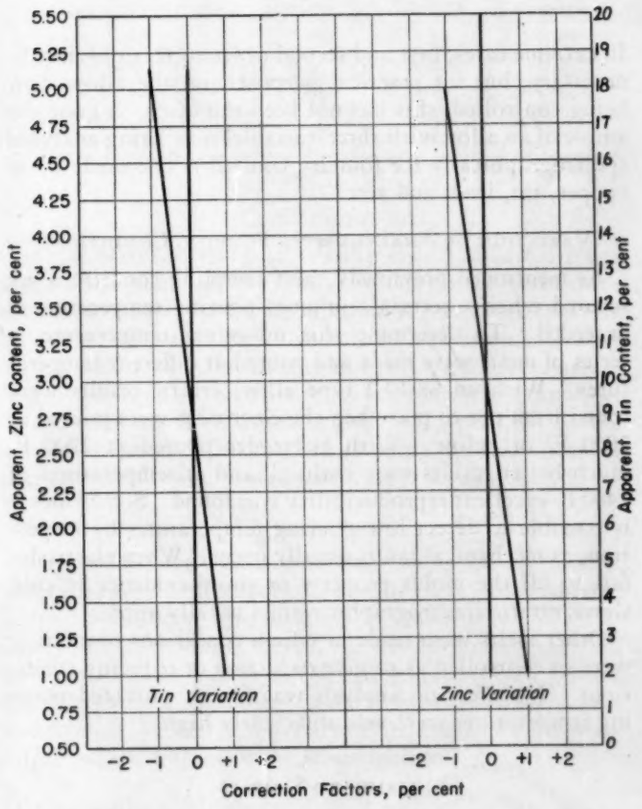


Fig. 9.—Correction Factors for Zinc and Tin.

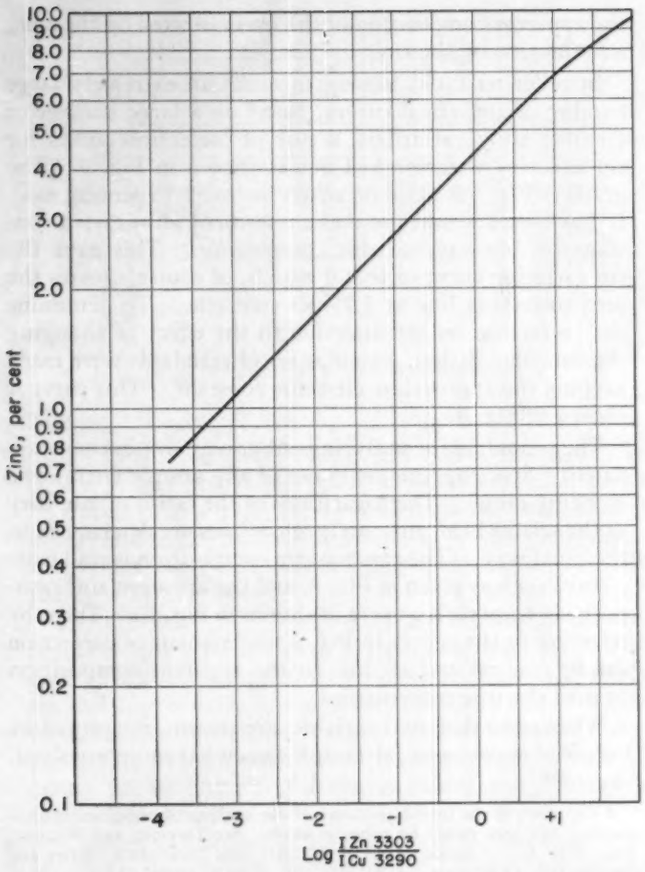


Fig. 10.—Working Curve for Zinc in 88-10-2 Type Alloys with Tin at 10 per cent.

In extreme cases, first and second order corrections may be necessary, but for practical purposes, on the alloys now being controlled, this has not been the case. A good example of an alloy with three variables now being analyzed spectrographically for foundry control is one made up of copper, tin, lead, and zinc.

Variation of Analysis with Pouring Conditions

As mentioned previously, best sampling conditions are secured when a certain minimum pouring temperature is exceeded. To determine this minimum temperature, a series of melts were made and poured at different temperatures. With an 88-10-2 type alloy, erratic results were found from pin to pin when the electrodes were poured at 2000 F. or below. With electrodes poured at 2200 F. much better results were realized, and at temperatures of 2400 F. excellent reproducibility was found. Sometimes it is possible to detect low pouring temperatures by inspection, as mechanical faults usually occur. When electrodes fail to fill the molds properly or show evidence of cold shuts, erratic spectrographic results usually appear.

Other melts were made in which conditions of melting were so controlled as to give oxidizing or reducing conditions. No effect on analysis was found, provided pouring temperatures were held sufficiently high.

Standard Samples

In all of this work on copper alloys the assistance of excellent chemical laboratories was available. Hundreds of samples were carefully analyzed at the Federal-Mogel laboratories, many samples were analyzed at the laboratories of the Department of Engineering Research at the University of Michigan, and a few at the National Bureau of Standards.

It is evident that great care must be taken with standard samples, both in preparation and in analysis. Failure to do so with problems offering so many variables can lead only to failure. The proof of careful workmanship in sample preparation is seen in our success in arriving at spectrographic controls of complex alloys containing relatively large percentages of alloying constituents.

Precision of Analysis

Before any new development can be used for routine control it must be thoroughly tested both in the laboratory and under actual operating conditions. With this purpose in mind, a sample of 88-10-2 type alloy was taken and analyzed a great many times under carefully controlled conditions. The electrodes were $^1/_4$-in. rods about $1^1/_2$ in. long. Flat surfaces were ground on each electrode between analyses and the edges were rounded off. A presparking time of 90 sec. was used with the spark circuit described, using the auxiliary air jet. No air was blown through the analytical gap. Exposure time was 35 sec. on a Cramer's contrast plate. Development was in normal Rodinal for $2^1/_2$ min. and the plates were calibrated with lines from a nickel spark spectrum. Results are shown in Table I.

TABLE I.—REPEAT ANALYSES FOR TIN ON STANDARD SAMPLE.

Microphotometric Reading, mm.		Log $\frac{I_{Sn3330}}{I_{Cu3338}}$	Deviation of Log $\frac{I_{Sn}}{I_{Cu}}$ from Mean
3338 Å, Copper	3330 Å, Tin		
First Plate			
297	335	0.35	0.003
340	370	0.34	0.013
351	380	0.35	0.003
356	383	0.34	0.013
360	889	0.37	0.017
345	376	0.36	0.007
317	355	0.38	0.027
327	356	0.30	0.053
358	389	0.39	0.037
336	371	0.39	0.037
311	348	0.36	0.007
326	361	0.36	0.007
Second Plate			
358	391	0.32	0.033
377	411	0.39	0.037
389	414	0.30	0.053
388	416	0.34	0.013
383	412	0.33	0.023
365	399	0.35	0.003
361	396	0.35	0.003
401	431	0.38	0.027
381	410	0.33	0.023
378	411	0.38	0.027
409	437	0.36	0.007
411	432	0.31	0.043
394	425	0.39	0.037
379	410	0.36	0.007
Average		0.353	0.0215

The data from the two plates listed in Table I are by no means all the data taken on these electrodes but are typical. From these measurements it can be seen that the average deviation from the mean is about 0.021 of a log unit. Referred to the working curve of Fig. 8, this amount shows an average deviation of 0.75 per cent of the amount of tin present at 10 per cent concentration. But what is perhaps more significant, the maximum deviation shown is 0.09 of a log unit, or a spread of 3.0 per cent. This means that at 10 per cent concentration for any analysis

TABLE II.—VARIATION OF TIN CONTENT WITH TYPE OF SAMPLING.

Type of Sample	Microphotometer Reading, mm.		Log $\frac{I_{Sn}}{I_{Cu}}$
	Copper 3338	Tin 3330	
Cast in Pyrex tube	245	295	0.50
	245	295	0.50
	230	280	0.50
	250	300	0.47
	225	270	0.48
	235	285	0.50
Sand-cast pins:			
Ends near hot top	340	375	0.45
Opposite ends	355	420	0.60
Middle of pin	365	415	0.55
Middle of pin	330	375	0.50
Sand-cast on metal plate:			
Ends of two pins	450	510	0.60
Opposite ends	387	430	0.60
Middle of pin	365	430	0.63
Middle of pin	440	500	0.60
Chill-cast large mold:			
Slug ends	390	450	0.60
Tip ends	445	505	0.60
Middle of pin	425	488	0.62
Middle of pin	410	470	0.60
Sand-cast:			
Large hot top:			
Tip ends	260	345	0.85
Slug ends	225	340	0.65
No hot top:			
Tip ends	265	340	0.75
Slug ends	260	337	0.77

taken the results should be accurate to at least ±1.5 per cent of the amount present.

Precision for Different Types of Sampling

Having established the probable error for a sample taken under carefully controlled laboratory conditions, the results taken on electrodes sampled in different ways can be examined. Table II is a summary of such measurements. The samples were not taken from the same melt, only from the same type of alloy.

The results shown in Table II were selected at random from many such determinations. The logarithm of the ratio of the intensities of the copper and tin lines remains within the limit of the spectrographic error for samples cast in Pyrex tubes, on metal plates, and in the chill-cast mold. The same comparison for sand-cast pins shows results too divergent to be explained in any way except from nonhomogeneity of the sample. If an alloy containing lead, such as 80 per cent copper, 10 per cent tin, and 10 per cent lead is studied in a like manner, the same general variations hold. However, in the case of lead, sand-cast samples and other samples poured with large hot tops show a larger total variation. In some sand-cast samples the lead variation from slug end to tip end was as high as 7 per cent. Since the expected error with good uniform samples should not exceed 3 per cent maximum spread, the variation found must be due to nonuniformity of sample. It should be pointed out, also, that the chemist is subject to the same type of error, and good agreement should not be expected between spectrographic and chemical analyses unless both samples are taken at the same point.

Routine Precision Tests

As a further check on the reliability of the above method, routine laboratory results on one set of electrodes

TABLE III.—ROUTINE REPEAT ANALYSES FOR TIN.

Log $\frac{I_{Sn3330}}{I_{Cu3338}}$	Tin, per cent
1.42	12.25
1.45	12.30
1.40	12.32
1.43	12.31
1.35	12.15
1.40	12.19
1.32	11.89
1.40	12.19
1.45	12.32
1.36	12.12
1.40	12.29
1.36	11.92
1.42	12.30
1.44	12.22
1.45	12.29
1.45	12.34
1.44	12.34
1.42	12.24
1.40	12.25
1.45	12.36

are given in Table III. The results shown were collected over a period of several months and seldom was more than one set of readings recorded on a single plate. Moreover, different operators performed the various operations and we may thus conclude that all known spectrographic errors are present. The results are within the expected range for routine procedures and verify the reproducibility predicted from rigidly controlled laboratory measurements such as are reported in Table I.

A comparison of concentration values of several copper-tin-zinc alloys, taken by chemical and spectrographic methods, are shown in Table IV. The samples for the chemical analysis were in most cases taken very close to the surfaces sparked for the spectrographic analysis.

TABLE IV.—COMPARISON OF VALUES OBTAINED BY CHEMICAL AND SPECTROGRAPHIC METHODS.

Sample	Tin		Zinc	
	Chemical Analysis	Spectrographic Analysis	Chemical Analysis	Spectrographic Analysis
No. 1	7.3	7.38	4.30	4.28
No. 2	7.53	7.61	4.45	4.36
No. 3	9.69	9.58	2.23	2.27
No. 4	9.83	9.81	2.47	2.56
No. 5	10.25	10.14	1.87	1.76
No. 6	10.06	9.88	1.98	2.07
No. 7	12.36	12.05	1.15	1.15
No. 8	12.77	12.74	1.43	1.43

Conclusions

It has been shown by laboratory tests and actual plant application that under rigorously controlled conditions the spectrograph can be used for making accurate analyses on copper alloys of high element concentration. During actual routine plant operating control, with proper sampling, it has been shown that the maximum error in analysis of any element should not exceed ±1.5 per cent of the amount present. The method is being applied to other non-ferrous alloys and will be reported at a later date.

Acknowledgment:

The authors wish to express their appreciation to O. S. Duffendack, North American Phillips Co., for valuable suggestions during the progress of the work; to E. R. Darby, Federal-Mogul Corp., for his helpful suggestions on metallurgical aspects of the problems involved and for his tolerant understanding of the difficulties encountered; and to R. G. Fowler, University of Michigan, for his work on the initial phases of the investigation.

[See p. 52 for Discussion]

DISCUSSION

MR. B. F. SCRIBNER.[1]—In connection with the sparking of flat steel specimens, it will be observed that as the inductance is decreased to relatively low values, for example, $L = 3\ \mu h$ and $C = 0.014\ \mu f$, the spark pattern will tend to be fixed in a small area on the surface. The shape of this pattern is practically independent of the surface condition of the steel specimen. I would like to ask Mr. Wolfe if his observation that the spark pattern on the copper covered a large area was made with a spark of low or high inductance relative to the capacitance.

MR. R. A. WOLFE[2].—The one with the extended surface was with high frequency and low inductance. It might be possible to increase the inductance enough to hold the spark down to a smaller area, but we were using it on our standard source and it was not convenient to increase the inductance enough to set up conditions that might be satisfactory with flat surface sparking. Moreover, a high-inductance spark on copper alloys, would have a tendency to localize on the grain boundaries and on small inclusions as pointed out in the paper. Conditions satisfactory for iron or steel analysis are often unsuitable for non-ferrous alloys.

MR. SCRIBNER.—What counter-electrode did you use?

MR. WOLFE.—We used copper in one case and carbon in another, and the results were not greatly different. This was true for copper alloys and also true of some other non-ferrous metals that we tried. It was found almost impossible, using the conditions that we had available, to provide a stable surface such that satisfactory spectrograms could be taken and repeated from day to day.

[1] Chemist, National Bureau of Standards, Washington, D. C.

[2] Research Physicist, Department of Engineering Research, University of Michigan, Ann Arbor, Mich.

A.S.T.M Standards Used in Cracking Plant

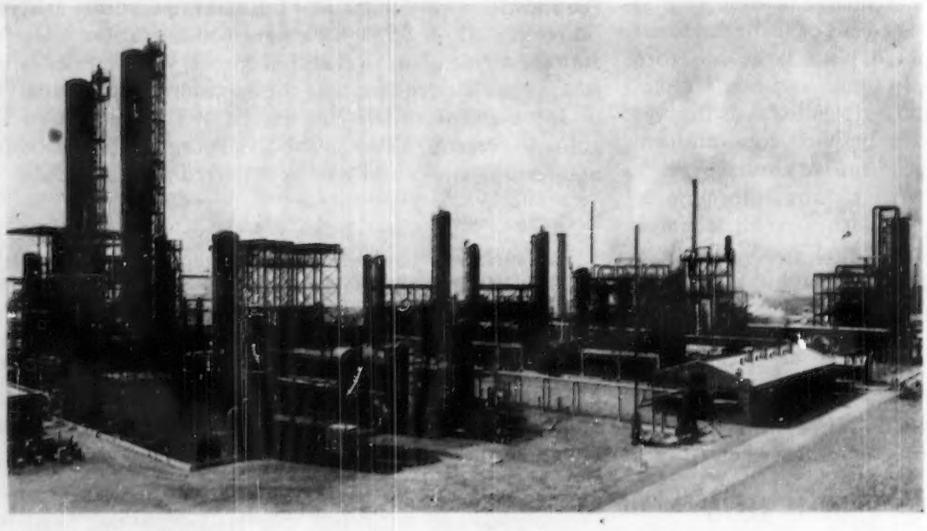
ANYONE FOLLOWING materials understands that A.S.T.M. specifications and tests occupy a most important position with respect to the purchase of engineering materials and also their production and application; but it is doubtful if many really have a conception of the very wide use of the Society's standards. Those at Headquarters get some idea by the large number of orders for the Book of Standards and separates as well as special compilations; those in particular industries who are testing materials have a partial picture in their specific field. Possibly the individual who really has as clear a conception as any is the one responsible for the design or metallurgical qualifications and other phases of a huge, new plant such, for example, as the Catalytic Cracking Plant of the Sun Oil Co. at Marcus Hook, Pa., which is a large and important source of aviation gasoline. Occasionally, there appears in the ASTM BULLETIN an article listing the specifications used in a particular project or by a company in its work, and, at our request, A. B. Bagsar, one of our active members, and Manager, Metallurgical Dept., Sun Oil Co., has sent a partial list of specifications made use of in connection with the construction of this huge, new plant illustrated in the accompanying picture. In addition to these standards, Dr. Bagsar points out that extensive use was made of A.S.T.M. tests, recommended practices, etc. In some cases, modifications were set up in certain of the specifications to cover specific applications somewhat more rigorously. These specifications were used in connection with pressure vessels, with the variety of equipment required in this plant, piping, etc.

LIST OF STEEL SPECIFICATIONS USED IN CRACKING PLANT.

Structural and Plate, Sheet, etc.	Reinforcement Bars, Commercial Bars, Rivet Steel, Bolting	Pipe	Tubing	Castings, Forgings, and Miscellaneous
A 7	A 15	A 44	A 83	A 47 A 217
A 10	A 107	A 53	A 161	A 48 A 221
A 70	A 108	A 74	A 179	A 95 A 222
A 78	A 141	A 106	A 192	A 105 A 233
A 167	A 193	A 120	A 199	A 157 A 234
A 176	A 194	A 135	A 200	A 181 A 235
A 201		A 139	A 213	A 182 A 248
A 240		A 155	A 249	A 198 A 251
		A 158		A 215
		A 206		A 216

LIST OF NON-FERROUS METAL STANDARDS

Bars, Shapes, Strip, Plate	Pipe and Tubes	Castings, Bearings
B 21 B 139	B 42	B 143
B 36 B 152	B 43	B 147
B 121 B 166	B 111	B 23
B 127 B 171	B 135	
B 138		



Sun Oil
Catalytic Cracking
Plant

Sustaining Memberships

SINCE THE May BULLETIN was published, three additional organizations have become sustaining members of the Society, bringing the total of this class of members to 191. The new sustaining members are as follows:

Weyerhaeuser Timber Co.—C. C. Heritage
Boeing Aircraft Co.—L. S. Marsh
Richard Johnson & Nephew, Ltd. (England)—Richard Johnson

Early this year details of sustaining membership were sent in the form of a brochure to all company members of the Society, and quite a number accepted the invitation to transfer their company membership to the sustaining class. In connection with sustaining memberships, it is of interest to note that, by action of the Executive Committee, a special certificate of sustaining membership has been transmitted to each of the sustaining members, this document being signed by the President of the Society in office at the time the membership became effective. The certificate is tendered as a token of appreciation for the support given the Society.

The accompanying facsimile shows the general design of the certificate, which is suitable for framing. The Texas Company, whose certificate is shown, was the first sustaining member, qualifying in September, 1931.


American Society for Testing Materials

ORGANIZED 1898 — INCORPORATED 1902

This is to certify that
The Texas Company
in 1931 became a
Sustaining Member
of the
American Society for Testing Materials
A Corporation formed for the Promotion of Knowledge of Materials of Engineering and the Standardization of Specifications and Methods of Testing

C. Lawrence Warwick, Secretary — K. B. Mackenzie, President

Symposium on Synthetic Rubbers Published

LATE IN JUNE the Symposium on the Applications of Synthetic Rubbers was completed and copies were mailed promptly to those who had ordered them. This publication, available in cloth or heavy paper cover, comprises the 13 papers which featured the Spring Meeting of the Society in Cincinnati in March. The symposium was developed through the intensive work of a special committee functioning under the auspices of Committee D-11 on Rubber Products, with Arthur W. Carpenter as chairman and a number of other active Society members serving.

The papers provide a very excellent picture of this field in which there is such intensive interest. Much of the information and data were compiled from a variety of sources by the authors and thus represent not one, but an over-all viewpoint. A statement in the introduction stresses the purpose of this publication: ". . . to present an authoritative compendium of present knowledge on the subject with full realization that such a summary cannot be complete at this time and may be of somewhat limited permanent value because of the rapid changes taking place. It hopes, however, that this small reference volume will be helpful to the users of synthetic rubber products in aiding them to select intelligently the types of material best suited to their needs and then to use those products under conditions which will assure satisfactory service."

A Special Order Blank was sent to members late in May. List prices to nonmembers: Heavy paper cover, $1.50; cloth, $1.75; to Society members, paper, $1.00; cloth, $1.25.

Discussion of 1944 Annual Meeting Papers

EACH YEAR a very considerable portion of discussion of papers and reports that is included in our *Proceedings* reaches us in the form of *written* discussion submitted after the Annual Meeting. As usual, written discussion of reports and papers presented at the 1944 Annual Meeting in New York City will be received by the Committee on Papers and Publications until September 15. However, all who plan to submit discussion are urged to send it to Society Headquarters as far in advance of this date as possible, in order to facilitate preparation of material for the *Proceedings*.

The value of this publication which every member receives is greatly enhanced by comments from various authorities on particular points as brought out by the author of a technical paper; such comments perhaps giving further data, or in some cases differing in interpretation of result.

Schedule of A.S.T.M. Meetings

DATE	COMMITTEE	PLACE
September 28	C-8 on Refractories	Mellon Inst. Pittsburgh, Pa.
October	Executive Committee	Headquarters Philadelphia, Pa.
October 12	Philadelphia District	Franklin Institute Philadelphia, Pa.
October 18–20	D-13 on Textile Materials	Park Central New York, N. Y.
October 24, 25	D-9 on Electrical Insulating Materials	Claridge Hotel Atlantic City, N. J.
October 26, 27	D-20 on Plastics	Claridge Hotel Atlantic City, N. J.

ASTM Bulletin

AUGUST 1944

NO. 129

TWO-SIXTY
SOUTH BROAD ST.
PHILADELPHIA, PENNA.

A Growing Society

As THE SOCIETY continues to grow, more specifically as it broadens its fields of activity to cover new materials and combinations, but also as the number of members increases, problems constantly arise which are more or less complicated. To an increasing extent as the older standing committees extend their scope of activities we find overlapping of interest with other A.S.T.M. technical groups. This continues to create problems requiring adjustment.

But we have reference particularly to publications and meetings. Nine years ago when the Book of A.S.T.M. Standards was still being issued in two parts, it covered some 3000 pages. Inability to handle such a mass of specifications and tests in two parts dictated a shift to three parts in 1939 which system was used again in 1942 and will be followed this year, but the limit is about reached on number of pages in the three parts with some 6000 involved. This volume of pages, of course, is due to the Society's great activity in developing important standard specifications and tests. Other publication problems are also confronting the Society. Obviously, a larger or more frequently issued BULLETIN would be a decided advantage in expediting publication of papers and reports and other items instead of waiting for the annual *Proceedings*.

With respect to meetings, the problems are many-fold involving first, physical accommodations. Frequently there are three large technical sessions running simultaneously with 20 to 30 committee meetings, and perhaps two or three other informal functions. To furnish rooms of the size and number required taxes the facilities of even the country's largest hotels. For example, this year in New York if there had been an Exhibit of Testing Apparatus and Related Equipment, the Waldorf, which it must be said has handled our complicated meetings with real efficiency, simply could not have coped with the added facilities required. Should we continue to have a five-day annual meeting, or should it be spread over a longer period? Or should the Society hold three or four formal business meetings during the year at which selected technical activities would be covered? A decided objection to the latter divisional plan is the great strength of the Society as a unit with the interests of members, whether from the producing or consuming standpoint, spreading across a wide path of materials.

Another problem is of an administrative nature, namely, to maintain and enlarge the Headquarters Staff to continue reasonably efficiently to handle the multitudinous details involved in our work.

All of these more or less involved situations are subject to a solution and the Study Committee is even now finding the answers to some of them, and with the Executive Committee will make recommendations which it is felt certain will insure a maximum of benefit to all of the members. This is the governing premise on which decisions of this kind are based.

An Interesting Message from the New President

No BETTER PROOF of the keen interest on the part of the members of the A.S.T.M. in its work could be found than in the records of the Annual Meeting in New York which has just passed into history. Nothing but a most compelling interest in the Society's activities could have brought about such largely attended meetings of such diversified interests under the existing conditions of travel on the railroads and sojourning in hotels.

It is clearly evident that the Society's widely diversified efforts do attract—in fact, almost compel—a very large number to take part in its annual gatherings. The latter are an evidence of the activities which have been maintained during the year previous to the meeting. The interest which has developed during the preparation of standards leads many to be present when these are presented at the Annual Meeting for acceptance by the Society subject to letter ballot, and also to be present at the committee meetings held during this time when so much work is discussed and planned for the coming year.

The good fellowship which has been engendered during the year's work also leads many more to desire to take part in the greater good fellowship which accompanies the annual sessions. In carrying out its standardization work, many phases of which cover decidedly "touchy" commercial angles, there has been developed a surprising degree of cordiality between those frequently having decidedly strongly held differing viewpoints.

Due to the many apparently very seductive attractions in New York City outside the meeting rooms of the Society, the Wednesday night session where so much of vital general interest was presented was relatively poorly attended. (Parenthetically it might be well to offset this competition next year—if the "duration" is still enduring—by having an open forum at this night session on such a subject as "Why Presidential Addresses, but if so—What?" well interspersed with professional demonstrations of "tripping the light fantastic.") Consequently, many members have missed the presentation of the Annual Report of the Executive Committee. It is suggested to these, and to those who have laid the preprint aside for later reading, that they carefully go through this synopsis of the Society's general activities. They should note especially what the Special Study Committee is doing. Through this report the members can obtain a better picture of how the Society operates and some better idea of the magnitude of the "machine" which functions to maintain the preparation and promulgation of standards. This

closer insight should surely arouse much interest and enthusiasm on the part of many.

The prospects for a busy, successful, profitable coming year are bright. It seems certain there will be no let-up in activities. But to assure this, some "sales talks" would not be amiss. Your President being entirely lacking as a salesman and as a talker bespeaks the help of those better endowed in these respects for continuing assistance in selling all of the Society's activities and in arousing the active support of all the members.

PRESIDENT

Committee Officers

IN THE BELIEF that a great number of members who have not had the privilege of meeting the officers of the Society's technical and district committees would note with interest photographs of these men, we begin in this issue to include pictures of the men who are responsible for the administration of the Society's major standing groups. No particular sequence is being followed, the procurement of photographs being subject to various factors including in a few cases the necessity of the editors more or less brow-beating quite a few of our modest officers to have their physiognomies appear in the BULLETIN. However, like good soldiers they are cooperating. Members must remember that no one is willing to admit that a photograph does him justice, but we will submit that our officers are reasonably good-looking, and—much more important—are as hard-working and as able a group of administrators and technical people as can be found.

Numerous Actions on Standards Submitted to Members for Letter Vote

BY ACTION of the Forty-seventh Annual Meeting, 181 recommendations from standing committees were approved for submission to letter ballot of the Society membership. These recommendations cover 78 tentative standards proposed for adoption as standard and the adoption as standard of 103 revisions in existing standards.

In connection with this detail of standardization procedure, it should be noted that only by letter ballot of the entire Society membership can changes be made in the formal standards. The action of an annual meeting session alone, or in the interval between annual meeting Committee E-10 on Standards, can approve for publication as *tentative* proposed new standards, can approve *revisions in tentative standards* (which are incorporated immediately), or can take action to permit publication as *tentative* of *proposed revisions in standards*. Many such actions, of course, are taken at the Annual Meeting and throughout the year by Committee E-10.

A complete list of the items to be voted upon appears in the letter ballot being sent in a separate mailing to the members. Detailed information concerning most matters referred to letter ballot is given in the committee reports issued in preprint form to the membership in advance of the meeting. The *Summary of Proceedings* accompanying the letter ballot contains a record of all actions taken at the annual meeting and also gives in full detail any changes in or additions to the standing committee recommendations as preprinted.

The ballot will be canvassed in September at which time all items receiving a favorable vote become effective.

All new and revised standards and tentative standards on which action was taken during 1944 will be published in the 1944 Book of Standards. While normally these standards would have been published in Supplements, as has been announced the complete Books of Standards will be issued in 1944 instead of 1945, appearing late this year. Meanwhile, many of the items will appear in various special compilations of standards relating to specific industries and for the most part all will be available in separate pamphlet form.

1945 National Meetings

DECISION HAS been reached by the Executive Committee to schedule the 1945 Spring Meeting and A.S.T.M. Committee Week from February 26 to March 2, 1945, at the Hotel William Penn in Pittsburgh. After detailed consideration of all factors including other industrial centers which might have been selected, Pittsburgh was chosen primarily because of its proximity to the center of gravity of Society membership.

At the same time, decision was reached to plan for the 1945 Annual Meeting during the week of June 25 to 29, New York City being designated the probable location, conditioned on making suitable hotel arrangements. Further information on these Society meetings will be announced and any changes in the time or location will be given promptly to the members. Considering current conditions, any decisions reached nine to twelve months ahead of the scheduled time of meeting are subject to change.

Secretary-Treasurer Discontinues WPB Work

EFFECTIVE MAY 31, 1944, Secretary-Treasurer C. L. Warwick resigned his position as Consultant to the Director of the Conservation Division, War Production Board, to devote his entire time to the activities of the Society. Since September, 1943, he had been giving about one fourth of his time to WPB work in the capacity as head of the Special Consultant Staff in the Conservation Division, devoting his time mainly to administrative and consulting service on specifications and construction materials and to his responsibilities as Administrator of the National Emergency Steel Specifications project. Prior to that time, he had served successively as chief of the specifications branch and then of the materials branch in the Conservation Division, having devoted the major part of his time to those activities since April, 1941.

Philadelphia District Plans Series of Meetings

Hardenability, Magnetic Particle Tests, Season Cracking, Experimental Stress

AN INTERESTING series of technical meetings have been planned by the Philadelphia District Committee—to feature discussions on hardenability and the use of hardenability data, a Symposium on Magnetic Particle Testing and Inspection to include several technical papers, in two sessions; and a third meeting dealing with design problems, concentrating particularly on stress, newer methods of testing, use of new gages to determine stress and the like.

The hardenability meeting is scheduled for October 12, and the Symposium on Magnetic Particle Methods will be the middle of January, perhaps in conjunction with Committee A-1 meetings, and the experimental stress science meeting in April.

Another feature of the Philadelphia program, although it is arranged by the national Society, is the joint A.S.T.M. -A.I.M.E. meeting on Season Cracking of Metals to be held in Philadelphia on November 29 and 30. The A.S.T.M. Philadelphia District Committee, and the local A.I.M.E. section will cooperate in plans for this Symposium.

Further details on all of these matters will be furnished to members through the October BULLETIN and by direct mail.

Meeting on Thermal Conductivity of Refractory Materials

AT ITS FALL meeting to be held on September 28 in Pittsburgh, A.S.T.M. Committee C-8 on Refractories will hold a discussion on methods of determining thermal conductivity of refractory materials at high temperatures. This is a field in which there is much interest and a number of independent investigators, in addition to members of Committee C-8 who have been vitally concerned with this problem, will participate in the discussion. Various methods of conductivity testing will be described and the tentative methods of testing thermal conductivity of fire brick (C 182 – 43 T) are to be critically discussed.

The committee extends a cordial invitation to any interested to attend the meeting.

Further details can be obtained from J. D. Sullivan, Chairman of the committee, Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio, or S. M. Phelps, Secretary, Mellon Institute of Industrial Research, Pittsburgh 13, Pa.

Secretary-Treasurer and Assistant Treasurer Honored

A SURPRISE FEATURE of the 1944 Annual Meeting's General Session on June 28 (surprise at least to the two recipients) was the presentation of testimonials and gifts of war bonds to Secretary-Treasurer C. L. Warwick and Assistant Treasurer J. K. Rittenhouse, who this year have completed 25 years of service in their respective offices. Each, however, has been associated with the Society for a longer period, Mr. Rittenhouse having been the first full-time employee. The testimonials presented in formal form to Messrs. Warwick and Rittenhouse appear below.

To C. Laurence Warwick

GREETING

As this Forty-seventh Annual Meeting rounds out your five and twenty years of faithful, effective service as Secretary-Treasurer of the American Society for Testing Materials, it is indeed a privilege and a pleasure to mark the occasion:

Through words that inadequately express our affection and regard, our recognition of your capable leadership, of your wisdom and vision, of your energy and thoroughness, of your clarity in thought and speech.

And through the attached more material evidence of our sincere appreciation of your personal friendship as well as your tireless guidance.

Your acceptance of these tokens of our esteem will be assurance to us that we are sharing good works and good fellowship as

MEMBERS OF THE SOCIETY

New York
June 28, 1944

In his response Mr. Warwick, after expressing thanks and appreciation, referred to the very close assistance and cooperation many Society leaders had given and he also referred to the work of the Headquarters Staff, and said he wished to share any credit for accomplishments for the Society with them. After indicating that perhaps the only real profit in reviewing 25 years of work is the lessons learned which can be applied in the future, he expressed a hope that he would be privileged to help in the future developments of the Society which should be very big and broad.

A large number of members of the Society had participated in the award and a great many letters of congratulation and commendation for the two officers were received by the committee in charge.

To John K. Rittenhouse

GREETING

As this Forty-seventh Annual Meeting rounds out your five and twenty years of faithful, effective service as Assistant Treasurer of the American Society for Testing Materials, it is indeed a privilege and a pleasure to mark the occasion:

Through words that inadequately express our affection and regard, our recognition of your canny administration of Society funds, of your painstaking stewardship of records, and of your ever-willing readiness to explain and to exhibit remarkable patience with the ever-changing Chairman of the Finance Committee.

And through the attached more material evidence of our sincere appreciation, of your personal friendship as well as your loyalty and dependability.

Your acceptance of these tokens of our esteem will be assurance to us that we are sharing good works and good fellowship as

MEMBERS OF THE SOCIETY

New York
June 28, 1944

List with Serial Designations of New and Revised Tentative Standards

61 New, 20 Extensively Revised

THE SOCIETY ACCEPTED at the Annual Meeting 61 new tentative standards and 99 former tentative specifications and methods of test which have been revised this year. Of the revised tentative specifications and test methods, 20 have been extensively revised and the titles of these are given below (marked with an asterisk) with the list of those issued by the Society for the first time. Standing committees responsible for the various items are indicated in italics.

New and Revised Tentative Standards

Corrosion of Iron and Steel; Magnetic Properties

(Committee A-5)

Specifications:
Lead Coating (Hot-Dip) on Iron or Steel Hardware (A 267 – 44 T).

(Committee A-6)

Definitions of Terms:
*Relating to Magnetic Testing (A 127 – 44 T).

Non-Ferrous Metals and Alloys

(Committee B-2)

Specifications:
Lead and Lead-Alloy Coated Wire for Electrical Purposes (B 189 – 44 T), formerly Emergency Specifications ES – 1a, revised.

(Committee B-3)

Methods:
*Salt Spray Testing of Non-Ferrous Metals (B 117 – 44 T).
Alternate Immersion Testing of Non-Ferrous Metals (B 192 – 44 T).

(Committee B-4)

Specifications:
*Drawn or Rolled Alloy, 80 per cent Nickel, 20 per cent Chromium, for Electrical Heating Elements (B 82 – 44 T).
*Drawn or Rolled Alloy, 60 per cent Nickel, 15 per cent Chromium, and Balance Iron, for Electrical Heating Elements (B 83 – 44 T).
Chromium-Nickel-Iron Alloy Castings ("25-12" Class) for High-Temperature Service (B 190 - 44 T), issued jointly with Committee A-10.
Method:
Test for Equivalent Yield Stress of Thermostat Metals (B 191 – 44 T.)

(Committee B-5)

Specifications:
*Copper-Base Alloys in Ingot Form for Sand Castings (B 30 – 44 T).

Cement

(Committee C-1)

Specifications:
*Air-Entraining Portland Cement for Concrete Pavements (C 175 – 44 T).
Method:
Test for Air Content of Portland-Cement Mortar (C 185 – 44 T).
Test for Heat of Hydration of Portland Cement (C 186 – 44 T).
*Chemical Analysis of Portland Cement (C 114 – 44 T), comprising new procedure for analysis of Vinsol resin in portland cement by the methoxyl method.

Lime

(Committee C-7)

Specifications:
Mason's Hydrated Lime (C 198 – 44 T).
Method:
Test for Arsenic in Lime (C 199 – 44 T).
Definitions of Terms:
Relating to Quicklime (C 51 – 44 T).

Refractories

(Committee C-8)

Symbols:
*Heat Transmission (C 108 – 44 T).

Concrete and Concrete Aggregates

(Committee C-9)

Methods:
*Test for Surface Moisture in Fine Aggregate (C 70 – 44 T).
*Test for Efficiency of Methods for Curing Concrete (C 156 – 44 T).
Making and Curing Concrete Compression and Flexure Specimens in the Laboratory (C 192 – 44 T).

Manufactured Masonry Units

(Committee C-15)

Specifications:
*Glazed Building Units (C 126 – 44 T).

Thermal Insulating Materials

(Committee C-16)

Specifications:
85 per cent Magnesia Thermal Insulating Cement (C 193 – 44 T), formerly Emergency Specifications ES – 8, revised.
Long-Fiber Asbestos Thermal Insulating Cement (C 194 – 44 T), formerly ES – 9, revised.
Mineral Wool Thermal Insulating Cement (C 195 – 44 T), formerly ES – 10, revised.
Expanded or Exfoliated Vermiculite Thermal Insulating Cement (C 196 – 44), formerly ES – 11, revised.
Diatomaceous Silica Thermal Insulating Cement, for Use from 1200 to 1900 F. (C 197 – 44 T), formerly ES – 13, revised.

Pigments and Paint Materials

(Committee D-1)

Specifications:
Raw Umber (D 763 – 44 T).
Burnt Umber (D 764 – 44 T).
Raw Sienna (D 765 – 44 T).
Burnt Sienna (D 766 – 44 T).
Venetian Red (D 767 – 44 T).
Yellow Iron Oxide, Hydrated (D 768–44 T).
Black Synthetic Iron Oxide (D 769 – 44 T).
Isopropyl Alcohol (D 770 – 44 T).
Methods:
Test for Daylight 45 Degree, 0 Degree Apparent Reflection of Paint Finishes (D 771 – 44 T).
Test for Water in Lacquer Solvents and Diluents (D 268 – 44 T).
Evaluating the Degree of Resistance to Flaking (Scaling) of Exterior Paints of the Linseed-Oil Type (D 772 – 44 T).
Definitions of Terms:
*Relating to Paint, Varnish, Lacquer, and Related Products (D 16 – 44 T).

Petroleum Products

(Committee D-2)

Methods:
*Test for Consistency of Lubricating Greases and Petrolatum (D 217 – 44 T).
*Test for Aniline Point of Petroleum Products (D 611 – 44 T).
*Test for Neutralization Number of Petroleum Products by Color-Indicator Titration (D 663 – 44 T).
*Test for Neutralization Number of Petroleum Products by Electrometric Titration (D 664 – 44 T).
*Test for Rust-Preventing Characteristics of Steam-Turbine Oil in the Presence of Water (D 665 – 44 T).

Road and Paving Materials

(Committee D-4)

Method:
Test for Hot Extraction of Asphaltic Materials and Recovery of Bitumen by the Modified Abson Procedure (D 762 – 44 T).

Paper

(Committee D-6)

Methods:
Test for Adhesiveness of Gummed Tape (D 773 – 44 T).
Test for Bursting Strength of Paper (D 774 – 44 T).
Drop Test for Shipping Containers (D 775 – 44 T).

Test for Effect of Heating on the Folding Endurance of Paper (D 776 – 44 T).
Test for Flammability of Treated Paper and Paperboard (D 777 – 44 T).
Test for Hydrogen Ion Concentration (pH) (D 778 – 44 T).
Test for Penetration by Water of Sized Paper and Paper Products (Dry Indicator Method) (D 779 – 44 T).
Test for Printing Ink Permeation of Paper (Castor Oil Test) (D 780 – 44 T).
Test for Puncture and Stiffness Testing of Paperboard, Corrugated and Solid Fiberboard (D 781 – 44 T).
Drum Test for Containers in Small Revolving Hexagonal Drum Box-Testing Machine (D 782 – 44 T).
Test for Water Vapor Permeability of Paper and Paperboard (D 783 – 44 T).

Electrical Insulating Materials

(Committee D-9)

Specifications:
Orange Shellac and Other Indian Lacs for Electrical Insulation (D 784 – 44 T).
Method:
Test for Indentation Hardness of Plastics and Electrical Insulating Materials (D 785 – 44 T), issued jointly with Committee D-20.

Rubber

(Committee D-11)

Specifications:
Cellular Rubber Products (D 798 – 44 T).
Methods:
Methods of Testing Sponge Rubber Products (D 552 – 43 T).
Test for Stiffening of Vulcanized Elastomers at Low Temperatures (D 797 – 44 T).

Soaps; Textiles

(Committees D-12, D-13)

Specifications:
Liquid Toilet Soap (D 799 – 44 T).
Method:
Chemical Analysis of Industrial Metal Cleaning Compositions (D 800 – 44 T).
Definitions of Terms:
*Relating to Soaps and Other Detergents (D 459 – 44 T).
*Relating to Textile Materials (D 123 – 44 T).

Naval Stores

(Committee D-17)

Methods:
*Sampling and Grading Rosin (D 509 – 44 T).
Sampling and Testing Dipentene (D 801 – 44 T).
Sampling and Testing Pine Oil (D 802 – 44 T).
Testing Tall Oil (D 803 – 44 T).
Definitions of Terms:
Relating to Tall Oil (D 804 – 44 T).

Plastics

(Committee D-20)

Specifications:
Cellulose Acetate Plastic Sheets (D 786 – 44 T).
Ethyl Cellulose Molding Compounds (D 787 – 44 T).
Methacrylate Molding Compounds (D 788 – 44 T).
Nylon Injection Molding Compounds (D 789 – 44 T).
Methods:
Flexural Test of Plastics (D 790 – 44 T).
Test for Luminous Reflectance and Transmission Characteristics and Color of Plastic Materials (D 791 – 44 T).
Test for Specific Gravity of Plastics (D 792 – 44 T).
Test for Short-Time Stability at Elevated Temperatures of Plastics Containing Chlorine (D 793 – 44 T).
Recommended Practices:
Determining Permanent Effect of Heat on Plastics (D 794 – 44 T).
Accelerated Weathering of Plastics Using S-1 Bulb and Fog Chamber (D 795 – 44 T).
Molding Impact Specimens of General Purpose Phenolic Material (D 796 – 44 T).

District Committee Personnel

EACH YEAR, under the staggering plan in effect, the terms of office of approximately one third of the members of the ten A.S.T.M. District Committees expire. Also, terms of officers of district committees expire with the even-numbered years, same as with the A.S.T.M. standing technical committees. Because of the widespread interest of members in district activities, there are given below lists of the officers for 1944–1946 of the various district committees and member appointments, with new appointments or elections indicated.

Also adjoining this article are groups of photographs of some of the district officers, it being the plan as indicated elsewhere in this BULLETIN to publish photographs of the standing committee and district officers.

During the past year a number of very successful local meetings were sponsored under district auspices with some of the papers and technical symposiums published as indicated in the 1944 Report of the Executive Committee. The basic functions of district committees are to promote the interests of the Society in the respective areas, but a number of specific activities are carried on; for example, several of the districts participate in technical society councils or groups as organized—in Cleveland, Chicago, Detroit, and other cities.

Officers of the Northern California District Committee—Dozier Finley, Chairman; Paul Garin, Secretary; and M. C. Poulsen, Vice-Chairman.

1944–1945 Programs:

As noted in this BULLETIN, the Philadelphia District group has a series of meetings in prospect; Pittsburgh and Chicago are developing meeting plans and announcements of other district plans will be made.

Chicago

Officers: J. F. Calef,* Chairman, Automatic Electric Co.; J. deN. Macomb, Vice-Chairman, Inland Steel Co.; J. J. Kanter,* Secretary, Crane Co.

Appointments: W. L. Bowler* Pure Oil Co.; Arthur Howe Carpenter, Illinois Institute of Technology; R. B. Harper, The Peoples Gas Light and Coke Co.; C. H. Jackman, Carnegie-Illinois Steel Corp.; A. M. Johnsen, The Pullman Co.; J. E. Ott, Acme Steel Co.; H. M. Robinson,* Underwriters' Laboratories, Inc.; T. H. Rogers, Standard Oil Co. (Indiana); D. D. Rubek,* Anderson-Prichard Oil Co.; G. E. Stryker,* Bell and Howell Co.

Cleveland

Officers: A. J. Tuscany, Chairman, Metal Lath Manufacturers Assn.; Arthur W. Carpenter, Vice-Chairman, The B. F. Goodrich Co.; R. T. Bayless, Secretary, American Society for Metals.

Appointments: R. T. Bayless, American Society for Metals; H. L. Ebert,* The Firestone Tire and Rubber Co.; J. H. Herron, The James H. Herron Co.; E. G. Kimmich, The Goodyear Tire and Rubber Co.; G. A. Reinhardt, The Youngstown Sheet and Tube Co.

* Indicates new appointment, or new election in case of officers.

Cleveland District Officers—A. J. Tuscany, Chairman; R. T. Bayless, Secretary; Arthur W. Carpenter, Vice-Chairman.

Detroit

Officers: Martin Castricum,* Chairman, United States Rubber Co.; W. P. Putnam,* Vice-Chairman, The Detroit Testing Laboratory; J. W. Kennedy,* Secretary, The Huron Portland Cement Co.

Appointments: V. A. Crosby,* Climax Molybdenum Co.; C. H. Fellows, The Detroit Edison Co.; J. H. Foote,* The Commonwealth and Southern Corp.; W. H. Graves, Packard Motor Car Co.; C. E. Heussner, Chrysler Corp.; Harry Kline,* Reichhold Chemical Co.

Northern California

Officers: Dozier Finley, Chairman, The Paraffine Cos., Inc.; M. C. Poulsen, Vice-Chairman, Port Costa Brick Works; Paul V. Garin,* Secretary, Southern Pacific Co.

Appointments: F. E. Baxter, Pacific Gas and Electric Co. (Alternate for F. M. Harris); Paul V. Garin,* Southern Pacific Co.; F. M. Harris (In Navy Service); R. A. Kinzie, Santa Cruz Portland Cement Co.; M. C. Poulsen, Port Costa Brick Works; F. D. Tuemmler,* Shell Development Co.; G. L. von Planck,* Columbia Steel Co.

Philadelphia

Officers: L. E. Ekholm,* Chairman, Alan Wood Steel Co.; J. F. Vogdes, Jr.,* Vice-Chairman, Philadelphia Committee of Pennsylvania Economy League; R. W. Orr, Secretary, Radio Corporation of America.

Appointments: G. E. Landt,* Philadelphia Textile Finishers, Inc.; J. C. Moore,* Sinclair Refining Co., Marcus Hook, Pa.; W. T. Pearce, National Research Council, Committee on Quartermaster Problems; A. O. Schaefer, The Midvale Co.; E. K. Spring, Henry Disston and Sons, Inc.; L. H. Winkler, Bethlehem Steel Co., Bethlehem, Pa.

Pittsburgh

Officers: Thomas Spooner,* Chairman, Westinghouse Electric and Manufacturing Co.; J. J. Shuman, Vice-Chairman, Jones and Laughlin Steel Corp.; P. G. McVetty,* Secretary, Westinghouse Electric and Manufacturing Co.

Appointments: J. J. Bowman, Aluminum Company of America; Dean Harvey, Westinghouse Electric and Manufacturing Co.; P. G. McVetty, Westinghouse Electric and Manufacturing Co.; J. J. Paine, City Engineer of Tests; Thomas Spooner, Westinghouse Electric and Manufacturing Co.

St. Louis

Officers: Hermann von Schrenk, Chairman, Consulting Timber Engineer; E. J. Russell, Vice-Chairman, Mauran, Russell, Crowell & Mullgardt; L. A. Wagner, Secretary, Missouri Portland Cement Co.

Appointments: J. C. Hostetter,* Mississippi Glass Co.; F. V. Reagel, Missouri State Highway Dept.; E. O. Sweetser, Washington University; Edward Weiland, City of St. Louis Municipal Research and Testing Laboratory.

Officers of the Chicago District Committee—J. F. Calef, Chairman; J. deN. Macomb, Vice-Chairman; and J. J. Kanter, Secretary.

Officers of the Detroit District Committee—J. W. Kennedy,[a] Secretary; W. P. Putnam, Vice-Chairman; and Martin Castricum, Chairman.

Southern California

Officers: E. O. Slater,* Chairman, Smith-Emery Co.; H. E. Jung,* Vice-Chairman, Southern California Edison Co.; H. W. Jewell,* Secretary, Pacific Clay Products.

Appointments: F. J. Converse, California Institute of Technology; C. E. Emmons,* The Texas Company; E. F. Green, Axelson Manufacturing Co.; H. E. Jung, Southern California Edison Co., Ltd.; R. E. Paine, Aluminum Company of America; R. H. Pierson, U. S. Naval Drydocks; E. O. Slater, Smith-Emery Co.

Philadelphia District Officers—J. F. Vogdes, Vice-Chairman; R. W. Orr, Secretary; and L. E. Ekholm, Chairman.

Western New York-Ontario

Officers: B. L. McCarthy, Chairman, Wickwire Spencer Steel Co., Buffalo; O. W. Ellis, Vice-Chairman, Ontario Research Foundation, Toronto; I. C. Matthews, Vice-Chairman, Eastman Kodak Co., Rochester; T. L. Mayer, Secretary, Department of Technology, Buffalo Public Library, Buffalo.

Appointments: B. L. McCarthy, Wickwire Spencer Steel Co.; T. H. Adair, Atlas Steels, Ltd.; E. H. Branson, General Railway Signal Co.; D. D. Crandell, National Gypsum Co.; W. P. Dobson,* Hydro-Electric Power Commission of Ontario; W. H. Rother, Buffalo Foundry and Machine Co.; Louis Shnidman, Rochester Gas and Electric Corp.

Officers of the Pittsburgh District Committee—Thomas Spooner, Chairman; J. J. Shuman, Vice-Chairman; and P. G. McVetty, Secretary.

[a] Just as this BULLETIN goes to press, news reached us of the untimely death of Mr. Kennedy, newly elected Secretary of the committee of which he has been a member for several years. Affiliated with the Society since 1922, he has served on the District Committee from 1935.

Extensive 1944–1945 Publication Schedule Includes Book of Standards, Special Compilations, Symposiums, and Other Material

Many Thousands of Pages Involved in the Society's Heaviest Schedule

INTENSIVE WORK is already under way on the heaviest publication schedule the Society has ever had, including as the most important item the 1944 Book of A.S.T.M. Standards which normally would not have been published until late 1945. On the list of books are numerous special compilations of standards which continue to comprise a very considerable volume of publication work, the annual *Proceedings*, and numerous special booklets and compilations, including several symposiums.

The total number of pages involved in these various books and pamphlets may reach more than 10,000. The Book of Standards itself will aggregate at least 6000 pages. Following the usual plan there will be sent to each member, probably in early October, a Special Members' Order Blank which will list all publications to become available. There will be brief descriptions of the books, estimated dates of publication, and a list of special prices to members.

Given below as advance information are notes on some of the regular and special publications that are included in this very heavy 1944–1945 schedule.

Regular Publications

1944 Book of Standards:

With the Book of Standards to be issued in 1944 the publication schedule is largely built around plans of issuing this tremendous volume, which will again come out in three parts, aggregating over 6000 pages—Part I, Metals; Part II, Nonmetallic Materials—Constructional; Part III, Nonmetallic Materials—General. (The volume containing the Methods of Chemical Analysis of Metals is not being reissued at this time). It is the plan to group the formal standards in the forepart of each book with the tentative standards grouped in the back portion. With many of the over 1200 specifications and tests affected by changes made this year or contemplated at the summer meeting of the Committee on Standards, and many new specifications to be edited and put in final shape, it is hazardous to give any exact date as to when the books can be expected. Also, printing and binding schedules continue to be so heavy that these are added uncertainties, but every effort is being made to have Parts I and II available for distribution early in December, and Part III either in late December or in early January, 1945.

1944 Proceedings:

The *Proceedings* of the Annual Meeting will again be issued as one volume including both committee reports and technical papers, with discussion. Printing of the *Proceedings* is being scheduled for late in the year, with distribution sometime in January, 1945. Meanwhile, many of the papers are being reprinted in advance; some committee reports are also being issued separately or as part of some one of the special compilations of standards. Estimated pages in the *Proceedings*, about 1350.

1944 Index to Standards and Tentative Standards:

This Index, which continues to increase in value as the number of specifications becomes larger, will again give the latest complete references to publications where the various specifications and test methods appear. The Index is furnished to members and is also widely distributed on request. Publication of the new edition is scheduled for February, 1945. This will probably aggregate 250 pages.

1944 Year Book:

Includes a list of the complete membership of the Society (name, classification, address, company, etc.), the personnel of all A.S.T.M. committees, and other pertinent information. Furnished only to members on request, for use in connection with activities of the Society. Publication date of this 360-page book—about November 1.

Special Compilations of Standards

The development of special compilations of standards has been one of the most interesting and notable phases of the Society's publication activities. These books, varying in size from 125 to 600 pages, comprise special groupings of standards that are of interest to specific industries, but in many cases include a considerable amount of other pertinent related data that are not strictly of a standards nature. Some of these data comprise tables, for example, humidity tables in the textile compilations; in other cases, values of standard samples, such as, in the refractories field; and in other cases reports on the significance of tests, part of the work on electrical insulating materials. Several of the books are far more than compilations of selected standards. The compilations have increased, not only in number of those published, but in the size of editions and the extent of material covered.

Aside from the value to the particular industries concerned, and by industry is meant either from the consuming or producing standpoint, these compilations inherently are extremely valuable in stimulating the use of standardized specifications and tests, and in acquainting those who use the books with some concept of the nature of the Society's important work in the field of materials.

In the following tabulation are listed the various compilations with approximate months of publication. Changes are quite apt to be made in these dates, since they are affected by printing schedules, committee actions, and other factors.

Committee Sponsoring	Title	Pages	Publication Date
A-1	Standards on Steel Piping	230	December
B-4	Electrical Heating and Resistance Alloys	170	December
B-5	Copper and Copper Alloys	412	December
C-1	Cement	148	September
C-9, D-4	Mineral Aggregates	140	September
D-2	Petroleum Products and Lubricants	464	September
D-5	Coal and Coke	160	September
D-6	Paper and Paper Products	160	January, 1945
D-9	Electrical Insulating Materials	540	January, 1945
D-11	Rubber Products	460	January, 1945
D-12	Soaps and Other Detergents	154	December
D-13	Textile Materials	484	October
D-18	Soils for Engineering Purposes (see Special Publications)		
D-20	Plastics	460	January, 1945

Other Special Publications

1944 Symposium on Plastics:

This extensive publication, to aggregate some 200 pages, comprises the 15 technical papers presented at the February, 1944, Symposium in Philadelphia by leading authorities, many quite active in the work of Committees D-20 on Plastics and D-9 on Electrical Insulating Materials, which committees joined with the Philadelphia District Committee in sponsoring the publication. The whole symposium is expected to be a most interesting and valuable one, and several of the papers are considered outstanding contributions which should be of much interest and help to those using or making plastics. While it had been hoped to issue the symposium in June, pressure of Annual Meeting matters delayed completion until the summer. The publication should be ready about August 30.

Symposium on Analytical Colorimetry and Photometry:

The two sessions at which the large number of papers and discussion were presented, comprising this symposium, were among the best attended at the Annual Meeting indicating widespread interest in this relatively new field. The publication will involve two sections, the instrumental one covering various photometers, filters, cells that are available, with several discussions on fundamental aspects. The chemical section gives specific methods for various materials with papers covering chemistry and colorimetry, and an extensive bibliography on various methods. Comprising about 150 pages, the symposium publication should be completed early in December.

Standards and Materials for Spectrographic Analysis:

This publication has resulted from an extensive survey conducted for the War Metallurgy Committee by Dr. W. R. Brode of Ohio State University. The survey, initially suggested by A.S.T.M. Committee E-2 on Spectrographic Analysis, has resulted in a great amount of valuable data of service in this important field, and the Society was pleased to act on a suggestion from the War Metallurgy Committee that it publish the report. While not an extensive publication (about 40 pages) it will serve an important need. Publication date: about September 30.

Soil Testing Procedures:

In addition to its 13 standardized methods of testing and definitions that already appear in the Society's publications, Committee D-18 on Soils for Engineering Purposes has been much concerned with developing other recognized tests for evaluating soils. This is a field where there have been a large number of ideas. Various authorities have submitted tests and almost 40 of these are included in this special compilation. It is hoped that as a result of this publication there can be a crystallization of ideas with respect to many phases of this broad and complicated field of activity. Covering about 260 pages, the publication should be available early in September.

Significance of Tests of Paper and Paperboard:

In preparation for many months, this publication, being sponsored by Committee D-6 on Paper and Paper Products, covers characteristics, nomenclature, and significance of tests of paper and paperboard. There are a great many tests for paper and paper products, (a number have been standardized by Committee D-6—there were numerous actions at the Annual Meeting approving new tests as developed by the committee) and authoritative statements on the significance of these should be of considerable value in clarifying many points. Included in the monograph is a discussion on properties of various classes of paper and other information provides a background of paper manufacture and the nature of paper.

The preparation of statements or reports covering the significance of tests of specific products is considered of much importance in the proper testing and evaluation of materials. Several have been prepared by Society committees in such fields as petroleum, concrete and concrete aggregates, coal and coke, and electrical insulating materials. The monograph on paper and paperboard, comprising about 170 pages, should be available in September.

1944 Edgar Marburg Lecture on Textile Fibers:

A most interesting Marburg Lecture was presented at the Annual Meeting by Dr. Harold DeWitt Smith on the subject "Textile Fibers—An Engineering Approach." Dr. Smith devoted much time to preparing material that would be of interest not only to textile technologists, but especially to the large and diversified group of consumers of all kinds of textiles. He has stressed the importance of a study of mechanical properties of textile fibers in relation to the desired properties in yarns and fibers whether so-called esthetic characteristics or utilitarian values. Prior to its publication in the 1944 *Proceedings*, the Lecture will be issued in reprint form and should be available about the middle of October. It will aggregate about 65 pages.

Miscellaneous Notes:

Other publications which will be included in the current schedule include the annual Reprint of the Report of Committee A-5 on Corrosion of Iron and Steel; the Symposium on Corrosion Cracking of Metals, which is scheduled to be held in late November in Philadelphia; and two reprints of earlier publications, editions of which have been exhausted, namely, the Report on Evaluation of Petroleum Products first issued in 1940 and the Manual on Presentation of Data which book has been reprinted several times. The special compilation of Standards for Students in Engineering, very extensively used in engineering schools throughout the country and which has been of great value in connection with the engineering management, science, and war training courses, also will be reprinted.

Great Activity in Development of Specifications and Tests for Materials—Many Items Nearing Completion

THE MATERIAL WHICH follows presents in condensed form notes on some of the major standardization activities under way in the respective materials fields covered by A.S.T.M. technical committees.

Presented as a summary rather than in detail because of the great amount of space which would be required if full discussions of the projects were to be given, the information should be of interest to all those concerned with the Society's standards work.

The material is compiled from two sources—statements received during the summer from the Society's committee officers and from current committee reports. It is apparent from a review of this material that there are large numbers of projects that will be completed during the next year, in fact many are now in final stages in anticipation of appearance in the 1944 Book of Standards, such action being possible through approval by Committee E-10 on Standards at its August 28 meeting or subsequently by letter ballot of this group.

The information which follows is recorded in the order of standing committee designations, that is, the "A" (ferrous) group, followed by the "B" group, non-ferrous, then the "C" and "D" groups in order.

Ferrous Metals

Steel.—Important new standardized methods and specifications which should be completed in the very near future in Committee A-1 on Steel include two methods of carrying out magnetic particle testing and inspection of heavy forgings and of steel castings. Intensive work has been under way for many months on each of these items because of the very great interest in the use of magnetic particle methods, and results have been awaited with much interest. No standards of acceptance or rejection as such can be included but the authorities participating have come to agreement on many important aspects involved. New specifications for carbon steel and alloy steel blooms, billets, and slabs for reforging purposes are practically completed and are now out to committee ballot. Concurrently with these new specifications there will be issued emergency alternate provisions covering the NE grades of steel. In cooperation with Committee A-10 four important new specifications covering various grades of austenitic and ferritic types of stainless steels for general purposes, for stills for refinery applications, and for the food and dairy industry are being approved.

Other projects in the steel committee include a separate specification for structural steel for welding, consolidation of some steel castings specifications in the interest of simplification, and establishment of steels which would inhibit graphitization, a subject of very intense concern to those involved in the high-temperature field. Of very widespread interest is work on specifications for carbon steel bars in the annealed and heat-treated condition, and also for alloy steel bars, it being the intention to include requirements on physical properties which would be expected from bar steels treated and stocked for immediate use. Important revisions are under way in the two existing commercial bar specifications covering hot- and cold-finished bars.

Cast Iron.—A thorough revision of the Specifications for Foundry Pig Iron (A 43) is under way. Studies are being made of requirements for the optional transverse test covered in the widely used Specification A 48 for Gray Iron Castings, with another matter also under study, namely, some guide as to Brinell hardness for various classes of gray iron castings. Proposed new standards for centrifugal pipe, and for cast iron for use in pressure parts within the temperature range 450 to 650 F., are under way.

Corrosion of Iron and Steel.—Since the standard stripping test A 153 is not entirely satisfactory for determining weight of coatings on malleable iron castings, improved procedures are under way; this work is related to proposed changes in the weight of coating requirements in the tentative specifications.

Magnetic Properties.—With the ultimate aim of developing standardized tests which should be of value in connection with induction heating and aircraft applications, Committee A-6 is carrying out tests involving determination of core loss at frequencies higher than power frequencies. Another project is the development of model requirements for electrical sheet and strip materials which should lead to a considerable simplification in the preparation of specifications and a greater uniformity of product. During the year the committee hopes to consolidate in the standard methods of test A 34 all of its procedures covering testing techniques, thus developing a document which would be compact and convenient.

Iron-Chromium and Related Alloys.—In Committee A-10, in addition to the work on the stainless tubing specifications discussed above, a new proposed procedure for total immersion testing is practically completed. Standardized requirements on stainless bar steel and for certain types of spring wires are nearing completion.

Non-Ferrous Metals and Alloys

Copper and Copper-Alloy Wires.—Committee B-1 has planned to prepare a new method for determining the resistivity of copper and copper-alloy wires for electrical

Officers of Committee A-3 on Cast Iron—E. R. Young, Vice-Chairman; C. O. Burgess, Secretary; J. T. MacKenzie Chairman

Officers of Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors. From left to right, E. H. Kendall, Acting Secretary, W. R. Hibbard, Vice-Chairman, and J. H. Foote, Chairman. Lt. Col. H. H. Stout, Jr., Secretary, is serving in England

conductors, to study values for the lengths of lay for inclusion in Table II of Tentative Specifications for Bunch-Stranded Copper Conductors for Electrical Conductors (B 174 – 42 T), and to consider the matter of providing necessary overages in areas of stranded conductor to allow for subsequent processing or for particular purchaser's requirements.

Corrosion.—A most important problem in the field of evaluation of non-ferrous metals and alloys involves accelerated corrosion tests. Recently there have been several technical papers and discussions on the salt spray procedure, and a conference of interested parties was held this spring at which was drafted a method that it is hoped will be satisfactory to all interested agencies. This is now being completed. Extensive revisions of the Salt Spray Methods, B 117, were made at the Annual Meeting to cover all points agreed on.

Electrical and Heat Resistance Alloys.—Standardization projects under way in Committee B-4 include requirements for certain high-alloy castings, tests for the elastic properties of special purpose spring alloys in wire and strip form at elevated temperatures, and methods of test are being studied for the determination of particle size and distribution of powdered materials used in electronic tubes and incandescent lamps.

Electrodeposited Coatings.—Of much interest in the preprinted report of Committee B-8 was the information on the plan of the performance test of electroplated lead coatings on steel with details of the preparation of the panel coatings, distribution of the panels, with some information on current results. Another project is a survey of the current practice of preparing high-carbon steel for electroplating, looking toward the preparation of a recommended practice.

Powder Metals and Products.—Committee B-9 on Metal Powders Products, one of the newer A.S.T.M. standing groups, has been making considerable progress. Several activities were discussed at its Annual Meeting. In work on nomenclature, a glossary of terms has been set up as a basis for preparation of standard terms. In the work on metal powders, tests are to be developed before specification work with efforts concentrated on apparent density, flow, screen analysis, subsieve particle size, compressibility and chemical analysis for metal powders.

The activities on metal powder products will, of course, be very ramified. A proposed specification for bearings has been studied by the subcommittee in charge, and active work is in progress on standards for structural parts. This is involved since three points of view must be considered, using test bars, test pieces from the parts, or tests on the actual parts themselves. In work on cemented carbides, a study is being made of the transverse rupture and Rockwell hardness tests.

Metallography.—The current report of Committee E-4 indicates that the principal activities of Subcommittee VI on X-ray Methods have been concerned with the work on powder analysis of the Joint Committee on Chemical Analysis by X-ray Diffraction Methods, and a working agreement has been reached whereby an appreciable amount of foreign data will be available for new reference cards. Several proposed recommended practices are nearing completion and it is expected that they will be ready for consideration during the year.

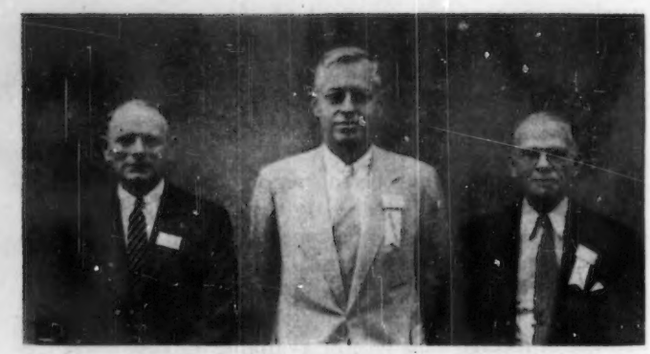
Cementitious

Cement.—Several important tests were standardized at the Annual Meeting as a result of work of Committee C-1. These involved determining the air content of mortars, vinsol resin in cement and heat of hydration. An early recommendation is expected concerning the feasibility of a short-time lean mortar bar test for evaluation of sulfate resistance.

Lime.—Problems on which Committee C-7 will concentrate during the year involve evaluation of workability tests with the extrusion machine and the modified vicat method. The autoclave test and methods for ascertaining sand-carrying capacity of masonry mortars will be studied. The committee will also attempt to standardize flow table tests. In the field of specifications, revised standards for masonry and finish limes are being studied and also master specifications for quicklimes and hydrated limes for the chemical industry are to be submitted to the main committee for vote.

Refractories.—Committee C-8's subcommittee on tests is reviewing all of its methods to determine whether the apparatus and equipment required are described adequately and in sufficient detail. In the work on temperature the committee is planning to have cone $32\frac{1}{2}$ standardized by the National Bureau of Standards. Nomenclature which is so important in the refractories field as with many other materials, has received much attention in the committee. Definitions for air-setting refractory mortar (wet and dry types) and for heat-setting refractory mortar (to replace the present general definition entitled "high-temperature bonding mortar") are in preparation. The subcommittee is also considering a definition for fireclay plastic refrac-

Officers of Committee C-5 on Fire Tests of Materials and Construction. From left to right, S. H. Ingberg, Chairman, H. M. Robinson, Secretary



Officers of Committee D-2 on Petroleum Products and Lubricants. From left to right, T. A. Boyd, Chairman; R. P. Anderson, Secretary; and T. G. Delbridge, Vice-Chairman.

tories. Whether the committee should develop specifications for fire clays in service conditions other than for laying up of refractories is now being studied.

As indicated elsewhere in this BULLETIN, the committee is planning to have at its September 28 meeting an open session with discussion on methods of determining thermal conductivity. All concerned are invited to attend.

Glass and Glass Products.—In its work on chemical properties, Committee C-14 has completed three methods for determining chemical durability, which are now receiving committee approval. In work on flat glass properties, tentative test methods are under consideration.

Paint, Gaseous Fuels, Coal and Coke, Paper, Timber

Paint, Varnish, Lacquer, etc.—Committee D-1 has many standardization activities under way in its numerous subcommittees. A polymerization test for processed drying oils and a test for the varnish making properties of drying oils are being studied. In the work on traffic paints night visibility is being investigated, and also tests for determining the bleeding characteristics of traffic paints and for evaluating the degree of settling. Problems in the field of volatile hydrocarbon solvents include solvency evaporation rate and tests for measuring corrosion stability and gum formation.

Work on methods of analysis is always important in this committee, current projects including methods for determining the pH of pigments, ease of grinding pigments, and determination of the dry hiding power of white and light tinted paints. In addition, to continuing the work on methods for testing resins, such as melting point, viscosity, color, and other properties, the committee is starting a new investigation on methods for measuring the water resistance of varnishes. A new specification for pumice which is used in traffic paints is to be approved.

Previously, the work on physical properties of Subcommittee XVIII included optical problems, but a new subcommittee X on Optical Properties has been organized with Subcommittee XVIII to function on other physical properties. New work includes the study of the measurement of infrared reflectance and luminescence.

Gaseous Fuels.—Based on very extensive research on determination of calorific value, Committee D-3 has completed a proposed method covering this. Sampling methods for natural, manufactured, and liquefied petroleum gases are also being prepared and also analytical methods for determination of total organic sulfur and other sulfur compounds. In connection with the work of this active committee, it is pertinent to note that an abstract of the very extensive report issued by the National Bureau of Standards on tests involving specific gravity instruments was published in the American Gas Association Journal. This will be of interest to many of those concerned. It is hoped the complete report can be issued soon. Results of the analyses of standard gas samples, carried out by several cooperating laboratories, are to be issued shortly with the remainder of the report to follow.

Coal and Coke.—As a result of detailed study, Committee D-5 is recommending more liberal tolerances for duplicate determinations of volatile matter for anthracite, low-temperature coke, and subbituminous coals. Several definitions of terms are being studied, and the method of drop shatter test for coal (D 440) is expected to undergo rather extensive revisions. As a result of experimental work on the Hardgrove-machine method for grindability of coal (D 409) some changes are expected. Satisfactory progress has been made in procedures for sampling large lump sizes of coal and sampling for moisture distribution.

Paper and Paper Products.—In addition to the large number of tentative tests accepted at the Annual Meeting, on the recommendation of Committee D-6—these included such tests for adhesiveness of gummed tape, bursting strength, drop test (shipping containers), and flammability (treated paper)—committee work on fiber board and fiber board containers during the coming year undoubtedly will include some of the following subjects: tape test on taped joints, beam test, adhesion test-combined corrugated board, immersion and delamination test, surface moisture test, score line tests, and impact strength of paperboard boxes.

Timber and Wood Products.—In connection with those phases of the work of Committee D-7 which involve specifications, the subcommittee concerned will keep in mind the desirability of correlating A.S.T.M. structural grades as closely as possible with those recommended by other organizations. In work on interpretation of results with fire tests, statements of various procedures are being prepared which will afford a critical analysis of different tests. Subjects to be covered by standards under consideration in the committee include wooden block flooring for interior use, treatments involving open tank and Bolton process and standards for coal-tar solutions or one or more salt preservatives, and in the field of moisture content, specifications or recommended practices covering the use of

Officers of Committee D-3 on Gaseous Fuels—R. B. Harper, Vice-Chairman; A. W. Gauger, Chairman; and R. M. Conner, Secretary.

Officers of Committee D-4 on Road and Paving Materials. From left to right: A. T. Goldbeck, Second Vice-Chairman; Shreve Clark, Chairman; E. O. Rhodes, Third Vice-Chairman; Prévost Hubbard, Secretary. First Vice-Chairman, W. J. Emmons was missing when photograph was taken.

apparatus and methods. Perhaps of primary interest is the committee's recommendation to publish as an A.S.T.M. tentative standard the proposed methods in the 1944 report on Testing Veneer, Plywood, Wood, and Wood-Base Laminated Materials.

A clarification of the committee's scope has been approved, which indicates it is concerned with wood, modified wood, veneer, plywood, and wood-base laminates. The committee's title also may be changed to connote a broader field than timber; a proposed title is Committee D-7 on Wood and Wood Products. The word timber frequently is associated with converted lumber.

Electrical Insulating Materials, Rubber Products, Soaps and Other Detergents, Aromatic Hydrocarbons and Naval Stores

Electrical Insulating Materials.—In work on insulating varnishes, Committee D-9 continues its active development of a suitable test to determine deep-drying properties of impregnating varnishes. A new section on thermosetting resin varnishes will develop test methods for time of set of these materials. The section on thermal properties is continuing studies of flammability tests. In the involved work on liquid insulation, tests for resistivity and power factor have been drafted, as has a procedure for determining actual percentage of small traces of moisture. Methods for evaluating high dielectric constant materials are under way, and specifications for waxes. In the work on mica, purchase specifications for both natural and bonded materials are being studied.

Rubber and Rubber Products.—In the field of automotive rubber, Committee D-11 continues to study specifications for coolant hose and other types, in some of which synthetic rubber is used. Proposed revisions in the widely used compounding Specifications D 735 are in prospect, covering applications of plastic compounds. Automotive gaskets are the subject of other specifications.

For insulated wire and cable where synthetics have been widely applied, additional specifications are being studied. In the subcommittee on chemical analysis, one problem involves methods of determining (both as to identity and quantity) various synthetic rubbers used in vulcanizing compounds. Expansion of the important methods of testing rubber-coated fabrics, D 751, is contemplated when agreement is reached, to include procedures for scrub resistance, abrasive resistance, flexing life, etc. Because it is important to have requirements on the cold conditioning of specimens prior to application of low-temperature tests, a proposed method on low-temperature conditioning is being drafted. The work of the subcommittee on low-temperature tests is one of the new and very important activities in Committee D-11.

Soaps and Other Detergents.—In its work on soap specifications, Committee D-12 plans to cover liquid soaps and rosin soaps, while in the field of analytical methods studies concern the determination of free alkali and carbonates in potash soaps, and analysis of mixtures of soaps and synthetic detergents. Standard methods for evaluating dry cleaning detergents and for their analysis are on the program. A new section has been formed to study performance tests in aqueous media. The committee will later study performance tests of dry cleaning soaps in nonaqueous media.

Industrial Aromatic Hydrocarbons.—This committee, organized in October, 1943, has been active on several problems, notably in studying simplified methods of tests and procedures for determining aromatic hydrocarbons in light oil. Some of the tests that may reach the status of proposed tentative standards during the year include the following: acid wash, acidity, color, odor, copper corrosion, distillation, nonvolatile matter, paraffins, solidifying point of benzene, and specific gravity.

Naval Stores.—During the past year Committee D-17 on Naval Stores has been carrying out a vigorous program, a number of phases of which will continue, including the important problem of methods for determining unsaponifiable matter in rosin, test methods for acid and saponification number of dark colored rosins. Softening point of rosin is an important problem with the committee investigating an air bath modification of the A.S.T.M. Ring and Ball Method E 28, also a "sinking mercury" method. In its 1944 Report were included for comment and information proposed methods of testing tall oil, dipentene and related terpene solvents and pine oil. These will be studied further. A new subcommittee to draft standard definitions applicable to all kinds of naval stores has been established, and the new subcommittee on rosin oil will first undertake to evaluate methods of test that are applicable.

Plastics.—To cover in detail the numerous standardization activities of Committee D-20 would require a very extensive article, so that only some items can be treated here. In work on strength properties, a test for bearing

Officers of Committee D-9 on Electrical Insulating Materials. From left to right, W. A. Zinzow, Secretary; Myron Park Davis, Chairman; and W. A. Evans, Vice-Chairman.

strength is under study and also the question of establishing identification tests. Activities on thermal properties include measurement of the coefficient of cubical expansion and deformation under load which application is particularly for softer rigid thermoplastics. Several problems involving optical and permanence properties are under investigation, including methods for haze and light transmission, accelerated weathering, and water vapor permeability, particularly on materials very impervious to moisture. There is much activity in specifications, with several new ones in prospect, and the subcommittee on analytical properties has numerous procedures under way on determining various elements and compounds.

Philadelphia Meeting on Hardenability Bands for Steel

ADDITIONAL DETAILS OF THE meeting on hardenability of steels, being sponsored by the Philadelphia District Committee at the Franklin Institute on October 12, have been received just as this BULLETIN goes to press. Three men who have had an important part in the development of information and data on hardenability and the hardenability bands, recently issued in the form of a publication by the American Iron and Steel Institute, will join in the interesting program.

A. L. Boegehold, Head, Metallurgical Dept., General Motors Research Laboratories, Detroit, will discuss "Selection of Automotive Steel on the Basis of Hardenability." Mr. Boegehold will cover the background and explanation of the use of hardenability bands. Messrs. Luther C. Boyd, Carnegie-Illinois Steel Corp., Pittsburgh, and Joseph Field, Bethlehem Steel Co., leading metallurgists who have carried out much of the work in the development of the bands will describe various experimental work that has been the basis of the bands, calculations involved, and related details.

To all those concerned with this important new method of buying bar and related steels, this session should be a "must attend" one. Those in charge of the meeting have stated, "There should develop a highly concentrated, intensive, instruction period on the use of the newest 'tool' for evaluation of the use and application of steels. It is even more fundamental than chemistry or theories of hardness. It applies to the steel, regardless of chemistry, the ultimate use to which that steel will be put."

The meeting will start promptly at 8 p.m., it having been the policy of the Philadelphia District to have technical meetings start on time, particularly where two or three speakers will participate in the program.

All A.S.T.M. members and others concerned are invited to attend.

Papers on Graphitization of Steel Piping

UNDER THE auspices of the Joint A.S.T.M.-A.S.M.E. Research Committee on the Effect of Temperature on the Properties of Metals there was held, at the A.S.M.E. Annual Meeting in New York in December, an interesting session on graphitization of steel piping with several pertinent technical papers. These have been edited and issued in the form of a 36-page booklet by the A.S.M.E. and a limited supply of the publication is available at A.S.T.M. Headquarters for distribution to A.S.T.M members. These papers will be of distinct interest to all those concerned with this vexing problem involving pipe at elevated temperatures.

Electronics Conference, Chicago, October 5–7

UNDER THE sponsorship of the Illinois Institute of Technology and Northwestern University, with the Chicago Sections of the American Institute of Electrical Engineers and the Institute of Radio Engineers participating, an extensive electronics conference is being held in Chicago from October 5 to 7, inclusive. A large number of technical papers involving fundamental developments and applications are scheduled and through the forum provided by the various sessions there will be an interchange of information and comments on various problems. The program is divided in accordance with the following main topic divisions: Television, Ultra-High Frequencies, Radio, Industrial Measurements and Special Devices, Industrial Electronic Controls, Induction Heating, Electronic Applications in the Power Field, Medical Applications of Electronics, and Recent Theoretical Developments in Electronics.

The conference is being held at the Medinah Club, 505 N. Michigan Ave., Chicago. Further information can be obtained from the Secretary of the Conference, B. Dudley, 520 N. Michigan Ave.

Fundamental Research

"ONE OF THE miracles of our generation is the way in which research men in industry are learning to gear in their development of practical accomplishments with the exploratory or fundamental types of research that characterize our university and industrial laboratories. This team play in a sympathetic atmosphere goes a long way in obviating some of the difficulties which faced both types of research men in the past.

* * *

"When peace comes, we may be confident that great advances will be made in the field of scientific research. But we must expect no miracles. Then we may get them. Certainly, if we have miracles, they will come through cooperative effort—hard, sweat-producing effort of scientists, management, and labor on the farm and in the factory . . . .

"Our advances will be made within the natural laws—the law of honest work for honest wage, the law of supply and demand, the law of competitive endeavor, and the saving grace of the ability of human animals to work cooperatively—which has raised them from the level of the brute.

"Of one thing we may be certain. American industry will continue to support and strengthen the faith we have in fundamental sciences. In the search for true knowledge and in the cooperative use of that knowledge, we shall build our future."

Exerpt from an address, "The Role of Industry in Strengthening Fundamental Research," by George A. Sloan, President, Nutrition Foundation Inc.

Officers of Committee E-2 on Spectrographic Analysis. From left to right, T. A. Wright, Vice-Chairman; Miss Mary E. Warga, Secretary; and H. V. Churchill, Chairman.

New Members to July 15, 1944

The following 143 members were elected from April 28 to July 15, 1944:

NOTE:—Company memberships are listed first under the respective districts, followed by individual and other members.

Chicago District

GORDON CO., CLAUD S., George A. Russ, Radiologist, 3000 S. Wallace St., Chicago 16, Ill.

MIDWEST PLASTIC PRODUCTS CO., William L. Hess, Production Manager, Twenty-ninth and Butler, Chicago Heights, Ill.

ROPER CORP., GEO. D., E. H. Shands, Chief Metallurgist, Blackhawk Park Ave., Rockford, Ill.

BRIGHTLY, FREDERICK CHARLES, JR., Vice-President, Standard Galvanizing Co., 2619 W. Van Buren St., Chicago 12, Ill. For mail: 734 N. Harvey Ave., Oak Park, Ill.

NILSON, H. N., Chief Metallurgist, Foote Bros. Gear and Machine Corp., 5225 S. Western Blvd., Chicago 9, Ill.

PFEFFERLE, PAUL RAYMOND, Chief Metallurgist, C. G. Conn, Ltd., Elkhart, Ind.

SEIFER, DANIEL, Vice-President in Charge of Production, Diamond Wire and Cable Co., Chicago Heights, Ill.

Cleveland District

HERRON CO., THE JAMES H., Lewis F. Herron, Secretary and Treasurer, 1360 W. Third St., Cleveland 13, Ohio.

NATIONAL ALUMINUM CYLINDER HEAD CO., Arthur J. Forro, Metallurgist, 3420 E. Ninety-third St., Cleveland 4, Ohio.

WELLMAN CO., THE S. K., J. R. Nurney, Vice-President, 1374 E. Fifty-first St., Cleveland 3, Ohio.

WHITE SEWING MACHINE CORP, Albert W. Locucco, Chemist, 1231 Main Ave., Cleveland 1, Ohio.

BONSACK, WALTER, Director of Laboratories, The National Smelting Co., Box 1791, Cleveland 5, Ohio.

STROHECKER, H. Ross, Research and Development Engineer, The Youngstown Welding and Engineering Co., 3700 Oakwood Ave., Youngstown, Ohio. For mail: 6215 Glenwood Ave. Extension, Youngstown, Ohio.

VALLÊ, CECILIO D., Manager, Ohio Coatings Co., 1171 E. Twentieth St., Cleveland 14, Ohio.

WHITELAW, S. W., Metallurgist, Otis Works, Jones & Laughlin Steel Corp., 3341 Jennings Rd., Cleveland 1, Ohio.

ZIESENHEIM, FRED C., Sales Manager, Lester Phoenix, Inc., 2711 Church Ave., Cleveland 13, Ohio.

Detroit District

FORD MOTOR CO. OF CANADA, LTD., Eric. M. P. Caunce, Metallurgist, Sandwich St., Windsor, Ont., Canada.

STANDARD TUBE CO., THE, S. L. Willis, Vice-President, 14600 Woodward Ave., Detroit 3, Mich.

GREENWOOD, EMMET H., Chief Engineer, Lake State Products, Inc., 1623 Wildwood Ave., Jackson, Mich. For mail: 133 N. Wisner St., Jackson, Mich.

KLINKER, LOUIS G., Captain; Chief, Materials Unit, Engineering Section, Office Chief of Ordnance, U. S. Army, 2422 Union Guardian Bldg., Detroit, Mich. For mail: 12766 Stoepel, Detroit 4, Mich.

WEBB, LLOYD E., Metallurgist, Frost Gear and Forge Division, Clark Equipment Co., Jackson, Mich.

New York District

AMBURSEN ENGINEERING CORP., S. W. Stewart, Secretary, 295 Madison Ave., New York 17, N. Y.

AMERICAN ELECTRO METAL CORP., Paul Schwarzkopf, Director of Research, 320 Yonkers Ave., Yonkers 2, N. Y.

ANDOVER KENT AVIATION CORP., T. A. Sharp, Chief Chemist, Allen Ave., New Brunswick, N. J.

ARIDYE CORPORATION, W. W. Chase, Director of Technical Publicity, 300 Plaza Rd., Fair Lawn, N. J.

ECLIPSE MACHINE DIVISION, BENDIX AVIATION CORP., James W Ryan, Metallurgist, Elmira, N. Y.

EDISON, INC., THOMAS A., D. L. Alfred, Chief Inspector, Instrument Div., Lakeside Ave., West Orange, N. J.

FEDERAL TELEPHONE AND RADIO CORP., LABORATORIES DIVISION, J. K. Whitteker, Laboratory Section Head, 67 Broad St., New York 4, N. Y.

KNICKERBOCKER DEVELOPMENT CORP., C. W. Dalzell, Director of Engineering, 116 Little St., Belleville, N. J.

PAISLEY PRODUCTS CO., INC. OF NEW YORK, L. J. LaBrie, Technical Director, 630 W. Fifty-first St., New York 19, N. Y.

REPUBLIC AVIATION CORP., R. C. Bergh, Chief Research Engineer, Farmingdale, L. I., N. Y.

SPONGE RUBBER PRODUCTS CO., THE, Ralph A. Holbrook, Vice-President, Howe Ave., Shelton, Conn.

STEINWAY AND SONS, P. H. Bilhuber, Vice-President, 109 W. Fifty-seventh St., New York 19, N. Y.

SULFLEX CORPORATION, William Hahn, Treasurer, 33-11 Fifty-seventh St., Woodside, L. I., N. Y.

ALLEN, FRANK B., Chief Engineer, C-O-Two Fire Equipment Co., U. S. Highway 1, Newark 1, N. J.

BEMIS, ELDRED W., Engineer of Tests, Elastic Stop Nut Corp., 328 Huguenot Ave., Union, N. J.

BRECKLEY, JOSEPH, Head of Rubber Lab., Titanium Pigment Corp., 99 Hudson St., New York 13, N. Y. For mail: 41 Howell Rd., Mountain Lakes, N. J.

BROWER, GILBERT K., Chief Materials Engineer, American Airlines, Inc., LaGuardia Field, New York Airport Station, N. Y.

COULTER, HAROLD B., Chief Mechanical Engineer, The Dorr Co., 570 Lexington Ave., New York 22, N. Y.

ENGELHARDT, CARL L., Chief Chemist, Brooklyn Varnish Manufacturing Co., Inc., 35 Nostrand Ave., Brooklyn, N. Y.

HIGGINS, T. R., Chief Engineer, American Institute of Steel Construction, 101 Park Ave., New York 17, N. Y.

JACKSON, WALTER L., Chemical Division Chief, Public Service Electric and Gas Co., 200 Boyden Ave., Maplewood, N. J. For mail: 86 Yantecaw Ave., Glen Ridge, N. J.

JAROS, FRANK, Research Director, Kompolite Co., Inc., 111 Clay St., Brooklyn, N. Y. For mail: 33-32 Seventy-sixth St., Jackson Heights, New York, N. Y.

KNAPPEN, THEODORE T., Consulting Engineer, Knappen Engineering Co., 132 E. Seventy-second St., New York 21, N. Y.

MAISEL, JACK, Electroplater, Bell Telephone Laboratories, Inc., 463 West St., New York 14, N. Y. For mail: 1181 Eastern Parkway, Brooklyn 13, N. Y. [J]*

MERRILL, TIMOTHY W., Metallurgist, Vanadium Corporation of America, 420 Lexington Ave., New York 17, N. Y.

NEWTON, WILLIAM G., JR., Vice-President, Newton-New Haven Co., 680 Third Ave., West Haven, Conn. For mail: Box 1101, New Haven 4, Conn.

NOLF, RALPH L., Engineer, Bendix Aviation Corp., 30 Rockefeller Plaza, New York 20, N. Y.

PETTY, PAUL BEAL, Mechanical Engineer, Hydrocarbon Research, Inc., 115 Broadway, New York 6, N. Y.

RAPUANO, ANTHONY D., Vice-President and General Manager, Bridgeport Thermostat Co., Inc., 1225 Connecticut Ave., Bridgeport 1, Conn.

SCHENK, RICHARD F., Assistant Chief Testing Engineer, Elastic Stop Nut Corp., Union, N. J. For mail: 61 Chestnut Ave., Irvington, N. J.

SMITH, GLENN P., Production Manager, Allied Asphalt and Mineral Corp., S. Second St., Dunellen, N. J.

WING, A. K., JR., Assistant Manager, Vacuum Tube Div., Federal Telephone and Radio Corp., 100 Kingsland Rd., Clifton, N. J.

ZURCHER, G. J., Member of Laboratory Staff, Bell Telephone Laboratories, Inc., 463 West St., New York 14, N. Y. For mail: 155 Summit St., Paterson 1, N. J.

Northern California District

WESTERN DIE CASTING CO., C. C. Voglesong, President, 4065 Hollis St., Emeryville 8, Calif.

FIELD, EDWARD, Chief Chemist, Arabian American Oil Co., 200 Bush St., San Francisco 4, Calif.

RAMSDEN, C. H., President, Pacific Coast Engineering Co., P. O. Drawer E, Alameda, Calif.

Philadelphia District

ASSOCIATED INDUSTRIAL ENGINEERS, INC., F. G. Daveler, President, Schaft Bldg., Philadelphia 2, Pa.

GENERAL SMELTING CO., J. Raymond Howland, Metallurgist, 2901 E. Westmoreland St., Philadelphia 34, Pa.

LINK-BELT CO., LeRoy S. Paulsen, Methods Engineer, 2045 Hunting Park Ave., Nicetown, Philadelphia 40, Pa.

BERTOLET, BENNEVILLE S., Project Engineer, The Baldwin Locomotive Works, Eddystone, Pa. For mail: 210-B Hiawatha Lane, Drexel Hill, Pa.

CULBERTSON, WILLIAM W., Major, Ordnance Dept., U. S. Army, Frankford Arsenal, Philadelphia 37, Pa.

FRANK, GLENN, Metallurgist, Harrisburg Steel Corp., Plant 2, Harrisburg, Pa. For mail: Oakwood Park, R. D. 1, Camp Hill, Pa.

HAGER, O. B., In Charge of Textile Chemicals Evaluation, Röhm & Haas Co., 5000 Richmond St., Philadelphia 37, Pa.

HURST, DEE A., Technical Assistant, Röhm & Haas Co., 222 W. Washington Square, Philadelphia 5, Pa.

KLINE, CLIFFORD MONROE, Electric Furnace Engineer, Ajax Electric Furnace Corp., Division of The Ajax Metal Co., 1108 Frankford Ave., Philadelphia, Pa. For mail: 6915 Horrocks St., Philadelphia 4, Pa.

MORELL, N. L., 311 Union Bank Bldg., Bethlehem, Pa.

NEWHARD, E. P., Supervising Chemist, Pennsylvania-Dixie Cement Corp., Nazareth, Pa.

PENNELL, FRANKLIN H., Metallurgist, DeLaval Steam Turbine Co., Trenton 2, N. J.

SCHOFIELD, R. S., Sales Engineer, Baldwin-Southwark Division, The Baldwin Locomotive Works, Eddystone, Pa.

* [J]—Denotes Junior Member.

Seibert, Charles Albert, Department Supervisor, Technical Lab., E. I. du Pont de Nemours and Co., Inc., Box 396, Wilmington 99, Del. For mail: 41 Chestnut St., Salem, N. J.

Vandegrift, Walter D., Surveyor, American Bureau of Shipping, 449 Bourse Bldg., Philadelphia, Pa. For mail: 544 Ferne Blvd., Drexel Hill, Pa.

Wright, W. Andrew, Development Engineer, Sun Oil Co., Development Div., Marcus Hook, Pa.

Zurbach, Eugene J., Jr., Chemist, Skillman Hardware Co., Trenton, N. J. For mail: 1304 Kerbaugh St., Philadelphia 40, Pa.

Pittsburgh District

Dill, Frederick H., Welding Engineer, American Bridge Co., Ambridge, Pa.

Gilliland, E. W., Chief Chemist, Mine Safety Appliances Co., Research Lab., 327 Craft Ave., Pittsburgh 13, Pa.

Lubker, Robert A., Non-Ferrous Metallurgical Engineer, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

Moser, Frank, Research and Development Chemist, Pittsburgh Plate Glass Co., Works 17, Creighton, Pa. For mail: 904 Ormond St., Tarentum, Pa.

Oswald, Louis W., Manager, Bar and Semi-Finished Materials Bureau, Carnegie-Illinois Steel Corp., 434 Fifth Ave., Pittsburgh 30, Pa. For mail: 121 S. Lang Ave., Pittsburgh 8, Pa.

Schane, Frank A., Manager, Railroad Materials and Commercial Forgings Bureau, Carnegie-Illinois Steel Corp., 770 Frick Building Annex, Pittsburgh 19, Pa.

Stickley, G. W., Aluminum Company of America, New Kensington, Pa. For mail: 424 Summit St., New Kensington, Pa.

St. Louis District

Mines Equipment Co., J. H. Simpson, Treasurer and Chief Engineer, 4215 Clayton Ave., St. Louis 10, Mo.

White-Rodgers Electric Co., J. A. Rodgers, Vice-President, 1209 Cass Ave., St. Louis 6, Mo.

Jablonsky, Roy, Highway Engineer, County of St. Louis, Clayton, Mo. For mail: 824 N. Price Rd., Clayton 5, Mo.

Kibby, H. A., Chemical Engineer, McQuay-Norris Manufacturing Co., 2320 Marconi St., St. Louis 10, Mo.

Ruggeri, Sam, Assistant Chemical Engineer, Houdaille-Hershey Corp., 800 E. Garfield Ave., Decatur, Ill. For mail: 1091 W. Macon St., Decatur 3, Ill. [J]

Strahl, Charles, Assistant Chemical Engineer, Garfield Division of Houdaille-Hershey Corp., 800 E. Garfield Ave., Decatur, Ill. For mail: 204 S. Crea St., Decatur, Ill. [J]

Southern California District

Pacific Pump Works, E. J. Weis, Vice-President, 5715 Bicket St., Huntington Park, Calif.

Simons Brick Co., Inc., Norman W. Kelch, Research Engineer, 1195 S. Boyle Ave., Los Angeles 23, Calif.

Greenhow, M. E., Berg Metals Corp., 2652 Long Beach Ave., Los Angeles 11, Calif.

Love, Thomas W., Engineer, Pacific Aviation, Inc., 9900 S. Lincoln Ave., Los Angeles, Calif. For mail: Box 93, Alhambra, Calif.

Western New York-Ontario District

Distillation Products, Inc., Norris D. Embree, Manager, Products Control Dept., 755 Ridge Road West, Rochester 13, N. Y.

Van der Horst Corporation of America, H. P. Munger, District Manager, Olean District, 403 Exchange Bank Bldg., Olean, N. Y.

Bund, Robert William, Mechanical Engineer, Scott Aviation Corp., Lancaster, N. Y. [J]

Fuenzalida, Javier H., Engineer in Charge of Refractory Projects, Corporación de Fomento de la Producción, Chilean Government, 120 Broadway, New York 5, N. Y. For mail: Box 143, Alfred University, Alfred, N. Y. [J]

Jarvis, Herbert O., Managing Director, Niagara Falls Smelting and Refining Corp., Buffalo, N. Y. For mail: 2206 Elmwood Ave., Buffalo 17, N. Y.

Sanden, Grant Emryn, Inspection Dept., The DeHavilland Aircraft of Canada, Ltd., Toronto, Ont., Canada.

U. S. and Possessions

Other than A.S.T.M. Districts

Atlanta & West Point Railroad, S. R. Young, Assistant General Manager, 4 Hunter St., S. E., Atlanta 3, Ga.

Black & Decker Manufacturing Co., The, David Middleman, Design Engineer, Engineering Dept., Towson 4, Md.

Fox Chemical Co., The, Robert K. Fox, Partner, 1270 E. Main St., Coshocton, Ohio.

Johnson Steel and Wire Co., Inc., C. E. Reardon, Sales Department Manager, Box 1211, Worcester 1, Mass.

Maytag Corp., The, E. C. Kroeger, Chief Engineer, Manufacturing Div., Newton, Iowa.

Monite Waterproof Glue Co., H. L. Prestholdt, President, 1628 N. Second St., Minneapolis 11, Minn.

Reynolds Corp., J. B. Whitley, Chief Chemist, Macon, Ga.

Rocky Mount Mills, Hyman L. Battle, Treasurer, Rocky Mount, N. C.

Thomas & Skinner Steel Products Co., E. R. Piercy, Factory Manager, 1120 E. Twenty-third, Indianapolis, 5, Ind.

Bishop, O. H., Chief Production Engineer, Reynolds Corp., U. S. Naval Ordnance, Macon, Ga. For mail: B-1 Vineville Court, Macon, Ga.

Boe, E. S., Research Chemical Engineer, Texas Gulf Sulphur Co., Newgulf, Tex.

Bottomly, Bruce E., Metallurgist, Greenfield Tap and Die Corp., Sanderson St., Greenfield, Mass.

Bruce, Donald S., Laboratory Director, The Gummed Products Co, Troy, Ohio. For mail: 318 S. Market St., Troy, Ohio.

Carney, W. M., Chief Chemist, Lion Oil Refining Co., El Dorado, Ark.

Castle, C. H., Chemical Engineer, The Sturgis Products Co., 203 Jacob St., Sturgis, Mich.

Chapel, Karl F., Senior Materials Engineer, Testing Lab., Pennsylvania Department of Highways, Galena Bldg , Franklin, Pa.

Coover, James H., Chief Chemist, D-A Lubricant Co., Inc., 1311 W. Twenty-ninth St., Indianapolis 8, Ind.

Cromb, Lester, Director of Research, The Dayton Malleable Iron Co., Box 980, Dayton 1, Ohio.

Edgerly, A. H., Foreman, Instrument Repair, Bendix Radio Division, Bendix Aviation Corp., East Joppa Rd., Towson, Md. For mail: 49 Burke Ave., Towson, Md.

English, James L., Assistant Chief Metallurgist, Easy Washing Machine Corp., Syracuse 4, N. Y.

Finlayson, Alexander, Technical Director, Pacific Car and Foundry Co., Renton, Wash.

Gillespie, W. F., Technical Director, Gaylord Container Corp., Bogalusa, La.

Hammond, Harry P., Dean, School of Engineering, The Pennsylvania State College, 203 Main Engineering Bldg., State College, Pa.

Hussey, Winston, Technical Director, Allied Materials Corp., Braniff Bldg., Oklahoma City 2, Okla.

Lundteigen, Andrew, Jr., Assistant Superintendent, Ash Grove Lime and Portland Cement Co., Louisville, Nebr.

Malpin, Arthur R., Tin-Lead Consultant, Metals Branch, Conservation Div., War Production Board, Washington, D. C. For mail: 1405 Webster St., N. W., Washington 11, D. C.

Metzler, H. Frank, Ensign, U. S. Naval Reserve. For mail: 2125 E. Oxford, Albuquerque, N. Mex. [J]

Mills, E. D., Chief Chemist, Mammoth-St. Anthony, Ltd., Tiger, Ariz. For mail: Box 56, Oracle, Ariz.

Moynihan, John R., Associate Professor, College of Engineering, Cornell University, Ithaca, N. Y.

Murph, Donald Bentley, Partner, Southern Lead Co., Box 5354, Dallas 2, Tex.

Pomfret, Richard A., Materials Engineer, Bethlehem Steel Co., Shipbuilding Division, 97 E. Howard St., Quincy 69, Mass.,

Souther, Roy Hobart, Chief Chemist, Proximity Manufacturing Co., Greensboro, N. C. For mail: Box 72, Denim Station, Greensboro, N. C.

Tuwiner, S. B., Research Engineer, Revere Copper and Brass Incorporated, Rome, N. Y.

Worley, Will J., Instructor in Theoretical and Applied Mechanics 316 Arthur Newell Talbot Lab., University of Illinois, Urbana, Ill. [J]

Other than U. S. and Its Possessions

Andes Copper Mining Co., I. L. Greninger, Petrerillo, Chile.

British America Paint Co., Ltd., A. W. McIntyre, Chief Chemist, Box 70, Victoria, B. C., Canada.

Compania de Refineria de Azúcar de Viña del Mar, Casilla 10-D, Viña del Mar, Chile.

Foundry Services Limited, K. Strauss, Director, Long Acre, Nechells, Birmingham 7, England.

Vigzol Oil Refining Co. (London), Ltd., The, Percy Bilton, Managing Director, 113 Park St., London, W. 1, England.

Black, James William, Senior Laboratory Assistant, National Research Council, Ottawa, Ont., Canada. For mail: 168 Dufferin Rd., Ottawa, Ont., Canada. [J]

Bonstow, Thomas Lacey, Consulting Engineer, Council of British Manufacturers of Petroleum Equipment, 40 Palace Chambers, Bridge St., London, S. W. 1, England.

Brill, Otto, Chief Chemist of Laboratory, M. Hochschild y Cia, Ltda., Casilla 396, Arequipa, Peru.

Maskell, L. O., Chief Chemist, Silvertown Lubricants, Ltd., Minoco Wharf, Silvertown, London, E. 16, England.

Millson, J. C., Engineer of Tests, Aluminum Laboratories Limited, Kingston, Ont., Canada.

Slater, Ian G., Principal Scientific Officer, Royal Naval Dockyard, Portsmouth, England. For mail: The Drift, Park Crescent, Emsworth, Hampshire, England.

Sykes, Charles, Director of Research, Brown-Firth Research Laboratories, Princess St., Sheffield, England.

Williams, Frank, Chief Mechanical Engineer, Canadian National Railways, 360 McGill St., Montreal, P. Q., Canada.

Personals

• • • News items concerning the activities of our members will be welcomed for inclusion in this column.

TOM BARLOW, formerly Foundry Engineer, Vanadium Corporation of America, Detroit, Mich., is now Research Engineer, Battelle Memorial Institute, Columbus, Ohio.

H. J. ROSE, who was Vice-President in Charge of Research, Anthracite Industries, Inc., Primos, Delaware County, Pa., is now connected with Bituminous Coal Research, Inc., Pittsburgh, Pa.

R. K. BOWDEN, formerly Manager, Metallurgical Dept., Chicago District, Carnegie-Illinois Steel Corp., Chicago, Ill., is now Director of Quality Control for the company with offices in Pittsburgh, Pa.

PAUL C. CUNNICK is now Lieutenant-Colonel, Officer in Charge of Laboratory, Rock Island Arsenal, Rock Island, Ill. He was formerly Materials Engineer, Rock Island Arsenal.

GEORGE H. YOUNG has been appointed Executive Assistant at Mellon Institute of Industrial Research, Pittsburgh, Pa. Dr. Young has been associated with the Institute since 1935, first as Industrial Fellow, then as Senior Fellow, on the Stoner-Mudge, Inc., Multiple Industrial Fellowship on Protective Coatings. His new duties will be concerned with the management of research programs of the Institute.

EDGAR C. BAIN, formerly Assistant to Vice-President, United States Steel Corp. of Delaware, Pittsburgh, Pa., is now Vice-President, Research and Technology, Carnegie-Illinois Steel Corp., Pittsburgh, Pa.

KENNLTH C. TIPPY who was formerly Assistant Professor of Civil Engineering, Syracuse University, Syracuse, N. Y., is now Professor, Department of Civil Engineering, The University of Connecticut, Storrs, Conn.

ROBERT E. WRIGHT is now Lieutenant, U.S.N.R., Beloit, Wis. He was formerly Mechanical Engineer and Contractor, Sierra Madre, Calif.

HARRY V. CHURCHILL, formerly Associate Professor of Mechanics, Case School of Applied Science, and member of the Cleveland District Committee, has recently been appointed to full professorship.

WILLIAM R. WEBSTER, Chairman of the Board, Bridgeport Brass Co., was recently honored at a dinner sponsored by the A.S.M.E., Bridgeport Section, in observance of Mr. Webster's 50 years' membership in that society. This function also honored Mr. Webster, who has been very active in A.S.T.M. work, for services and leadership not only in the field of mechanical engineering but also in his local community. Mr. Webster has been a member of A.S.T.M. for 25 years and has been concerned particularly with the technical work in the field of non-ferrous metals and alloys.

J. D. TYSON, formerly Manager, Sales and Metallurgy, Standard Steel Works Division, The Baldwin Locomotive Works, Burnham, Pa., is now Vice-President of the Standard Steel Works Division.

ROLFE H. EHRMANN is now connected with S. H. Kress and Co., New York, N. Y., as Chief Chemist. He was Research Chemist, Kollsman Instrument Division of Square D Co., Elmhurst, L. I., N. Y.

EDWIN K. SMITH is now Metallurgical Specialist, U. S. Department of State on Detail to Government of Republic of China, S.E.A. Division, China Section, Washington 25, D. C. He has established his permanent home in Beverly Hills, Calif.

FORD FISHER is now Southwestern Manager of the Thew Shovel Co., and will hereafter be located in Dallas, Texas. He was formerly located with the company in Lorain, Ohio.

E. P. STROTHMAN is now Consulting Engineer, A. O. Smith Corp., Chicago, Ill.

At its spring convocation on June 3, Ohio State University awarded the following two A.S.T.M. members honorary doctor of science degrees: THOMAS MIDGLEY, JR., Vice-President, Ethyl Corp., Worthington, Ohio, and President of the American Chemical Society; and ARNO C. FIELDNER, Chief, Fuels and Explosives Service, U. S. Bureau of Mines, Washington, D. C. Mr. Midgley is credited with notable inventions and discoveries in the fields of tetraethyllead, organic fluorides, and synthetic rubber. Dr. Fieldner is described as "probably the most outstanding engineer in the world in the field of fuels" and has been honored twice previously by Ohio State for engineering achievements, receiving the Benjamin G. Lamme and Joseph Sullivant Medals, and was the second American to receive the Melchett Medal from the British Institute of Fuel.

WILLIAM H. WILKINSON, formerly Superintendent, Oliver Johnson and Co., Inc., Providence, R. I., is now Paint Superintendent, U. S. Gutta Percha Paint Co., Providence, R. I.

R. W. ARCHER is now Consultant Inspector, C. L. McQuillan, Toronto, Ont., Canada. He was in the Inspection Department, The De Havilland Aircraft of Canada, Ltd., Toronto.

W. T. GRIFFITHS, Manager, Research and Development Department, The Mond Nickel Co., Ltd., Battledown, Cheltenham, England, was elected President of the Institute of Metals at the thirty-sixth annual general meeting of the Institute held March 15 in London.

JOHN E. ARNOLD, who was formerly with the United Shoe Machinery Corp., Beverly, Mass., is now located at Massachusetts Institute of Technology, Cambridge, Mass.

H. J. ROWE, formerly Metallurgical Engineer, Aluminum Company of America, Cleveland, Ohio, is now Chief Metallurgist of the Castings Division.

C. W. BLACKETER is now Sales Engineer, G. A. Sharry and Co., Inc., New York 4, N. Y. He was Chemist, Tungsten Plantation, Lamont, Fla.

SIDNEY BORN, formerly Consulting Chemist, University of Tulsa, Tulsa, Okla., is now connected with Born Engineering Co., Tulsa, Okla.

J. EDWARD DONNELLAN, formerly secretary of A.S.M. (American Society for Metals) national technical committees and the Metals Handbook Committee, in Cleveland, Ohio, has accepted a position as Vice-President in Charge of Sales of the General Alloys Co., Boston, Mass. Mr. Donnellan will continue to act as secretary of the Metals Handbook Committee.

H. N. CEDERGREN, formerly Metallurgist and Chief Chemist, Southern Lead Co., Dallas, Texas, is now Metallurgist, Aluminum Foundry, North American Aviation, Inc., Grand Prairie, Texas.

ARTHUR P. CLARK is now Research Associate, American Iron and Steel Institute, Washington, D. C. He was Sales Agent, Division of Building Specialties, Bethlehem Steel Co., Inc., Bethlehem, Pa.

WILLIAM C. FOX, formerly Chief Metallurgist, Empire Sheet and Tin Plate Co., Mansfield, Ohio, is now Technical and Assistant Plant Manager, Empire Steel Co., Mansfield.

CHARLES B. BRYANT, Assistant to Vice-President, Research and Tests, Southern Railway System, Washington, D. C., is on leave of absence from Southern and is serving as Director of the War Production Board's Transportation Equipment Division.

CHARLES D. YOUNG, Vice-President, The Pennsylvania Railroad Co., Philadelphia, Pa., in addition to his duties as deputy director of the Office of Defense Transportation, has recently agreed to accept the chairmanship of the Transportation Equipment Committee of the Combined Production and Resources Board.

FREDERICK W. ADAMS, Chemical Engineer, Pittsburgh Plate Glass Co., Pittsburgh, Pa., has been appointed Director of Research of the Clark Thread Co., Newark, N. J., and associated companies and will make his headquarters at the New York offices of the company. He will be responsible for the development of plans for the coordination and expansion of research within this organization.

H. K. NASON, formerly Assistant Director of Research, Monsanto Chemical Co., Springfield, Mass., has been transferred to the company's Central Research Laboratories in Dayton, Ohio, to become Director of Development of the laboratories there.

ZAY JEFFRIES, Technical Director, Incandescent Lamp Department, General Electric Co., Nela Park, Cleveland, Ohio, has been elected to the board of trustees of Battelle Memorial Institute.

WILLIAM HEILIG, Vice-President in Charge of Engineering and Development, The William Powell Co., Cincinnati, Ohio, was re-elected Vice-President of the company at their annual meeting held recently.

LA WALL AND HARRISSON, consulting and testing organization in Philadelphia, specializing particularly in the pharmaceutical and food fields, recently opened their new and expanded laboratory facilities on their seventy-fourth anniversary. The new laboratories are located at 1921 Walnut Street.

D. M. STEMBEL has been appointed Vice-President of Lockhart Iron and Steel Co., Pittsburgh, Pa. He was formerly Manager of Sales, Flat Rolled Products, A. M. Byers Co., Pittsburgh, Pa.

WESLEY E. CURTIS, formerly Research Fellow, New York State College of Ceramics, Alfred, N. Y., is now Research Engineer, Woods Hole Oceanographic Institution, Woods Hole, Mass.

WARNER A. SHERRER is connected with the Metallurgical Laboratory, University of Chicago, Chicago, Ill., as a Spectrographer. Formerly he was Metallurgical Laboratory Coordinator, Brewster Aeronautical Corp.

PROFESSOR FRANCIS M. McCULLOUGH, former Head of the Civil Engineering Department, Carnegie Institute of Technology, retired on July 1 after a long period of service with that Institution. When the Civil Engineering Department became affiliated with the A.S.T.M. in 1911, he was designated the representative, at that time being an assistant professor of materials. He has been professor and Head of the Department for many years. Professor McCullough has served as a member of the Pittsburgh District Committee for some time. His home is 5454 Fair Oaks St., Pittsburgh, Pa.

WALTER M. MITCHELL, formerly Chief Metallurgist, York Safe and Lock Co., Special Ordnance Plant, York, Pa., is now director, Engineering Department, Research Division, Mack Manufacturing Corp., Plainfield, N. J.

HORACE E. RILEY, Chief Chemist, Manufacturing Division, Bakelite Corp., Bloomfield, N. J., is General Chairman of the forthcoming one hundred and eighth national meeting of the American Chemical Society to be held in New York City in September.

A. O. SCHAEFER, formerly Engineer of Tests and Inspection, The Midvale Co., Nicetown, Philadelphia, Pa., has recently been appointed Executive Metallurgical Engineer.

H. D. NEWELL, Chief Metallurgist and Director of the Research Laboratory of Babcock & Wilcox Tube Co., Beaver Falls, Pa., is this year celebrating 25 years of continuous service with the company. He came to Babcock & Wilcox Tube Co. as Chief Chemist in 1919. The technical staff then included two other people, and now the laboratory has grown to include a personnel of more than 70, functioning in a building occupied by both production and research staff. Mr. Newell is very active in A.S.T.M. work. He serves on several technical committees, and since 1930 has been Secretary of Committee A-10 on Iron-Chromium-Nickel and Related Alloys.

WILLIAM M. HEPBURN, Librarian, who has represented the Purdue University Library, Lafayette, Ind., in the Society since 1908, is retiring from this position.

SELIG WILNER, who was Metallurgical Supervisor, Remington Rand, Inc., Propeller Division, Johnson City, N. Y., is now Engineer in Charge of Quality Control, Lear Avia, Inc., Piqua, Ohio.

NECROLOGY

We announce with regret the death of the following members and committee members:

CLOYD M. CHAPMAN, Consulting Engineer and Patent Solicitor, Glen Cove, N. Y. (See accompanying note.)

VIRGIL R. FLEMING, Assistant Professor of Applied Mechanics, University of Illinois, Urbana, Ill. Member since 1914.

WINSLOW H. HERSCHEL, Associate Materials Engineer (Retired), Na-

tional Bureau of Standards, Washington, D. C. Member since 1915. For many years Doctor Herschel was a member of Committee D-2 on Petroleum Products and Lubricants and several of its subcommittees, and served on other technical committees. He wrote a number of authoritative papers involving lubricating oils, gasoline, etc., and was extremely active in fundamental work involving our knowledge of viscosity.

HARRY A. LINCH, Manager, Engineering Dept., The Dorr Co., Inc., New York, N. Y. Member since 1937.

HORACE C. PORTER, Consulting Chemical Engineer, Philadelphia, Pa. Member since 1914. Doctor Porter was a long-time member of Committee D-5 on Coal and Coke, was Vice-Chairman, and served on many of its subcommittees, being Chairman of Subcommittee II on Nomenclature and Definitions at the time of his death. He was a member of Committee E-8 Nomenclature and Definitions representing Committee D-5, and was a member of the Subcommittee on Methods for Density of Committee E-1 on Methods of Testing. An authority on coal, oil and gas, their production and use, also explosions and related problems, Doctor Porter had been active in his chosen field for 40 years and had written extensively.

JOHN GEORGE STADLER, Chief Chemist, Iola Plant, Lehigh Portland Cement Co., Iola, Kans. Member since 1934.

DENNISTOUN WOOD, Engineer of Tests, Southern Pacific Co., San Francisco, Calif. Mr. Wood represented his company on Committee D-2 on Petroleum Products and Lubricants for many years and was a former member of the ASA Sectional Committee on Petroleum Products and Lubricants. A member since 1936 of Committee D-12 on Soaps and Other Detergents, and several subcommittees, he also served the Society for a number of years as a member of the Northern California District Committee.

LOUIS P. GOULD, Inland Manufacturing Div., General Motors Corp., Dayton, Ohio, one of the representatives of his company on Committee D-11 on Rubber Products, had been very active, particularly as chairman of the Subcommittee on Sponge Rubber. One of his contributions to the Society's work was an authoritative paper dealing with cellular rubbers, comprising part of the Symposium on Applications of Synthetic Rubbers which has just been published.

THOMAS I. CURTIN, President and Treasurer, Waltham Foundry Co., Waltham, Mass. Member since 1937. Mr. Curtin served as a member of Committee A-3 on Cast Iron from 1937 until the time of his death.

HENRY L. HOWE, City Engineer, Rochester Department of Public Works, Division of Engineering, Rochester, N. Y. At the time of his death Mr. Howe represented his department in its membership on Committee D-4 on Road and Paving Materials and certain of its subcommittees. He was a former member of the Sectional Committee A 37 on Road and Paving Materials. He had taken an active part in A.S.T.M. work in the Rochester area.

CLOYD MASON CHAPMAN
1874–1944

IN THE DEATH on July 2 of Cloyd M. Chapman, Past President and Honorary Member, the Society has lost one of its outstanding leaders—one of its elder statesmen. Mr. Chapman held many positions of responsibility; he also played an important part in the counsel of the Society.

Mr. Chapman prepared for Cornell University at Buchtel College in Akron, Ohio. He took the mechanical engineering course at Cornell University, Class of '98, and interrupted his course to enter the Navy as Engineer Officer (Ensign) during the Spanish-American War. Later he entered the employ of Thomas A. Edison, serving as assistant in his laboratory at West Orange, and also in mining exploration and development in Canada, New Mexico, and Australia.

In 1905 he entered the employ of Westinghouse, Church, Kerr and Co., as construction engineer, and later as engineer in charge and engineer of tests in charge of laboratory examination of materials of construction. He specialized in power plant and manufacturing plant design and construction, and in design of special machines. He has been in consulting engineering practice since 1920.

His interests were many and diverse which fact is reflected in the various committees on which Mr. Chapman served. He had been a member of Committee D-7 on Timber since 1911; a member of Committee C-9 on Concrete and Concrete Aggregates since its organization in 1914, having served as chairman of the committee from 1926 to 1932; and he was also interested in the work of Committee A-5 on Corrosion of Iron and Steel and served as a member of that committee since 1914. He was also a member of Committee D-1 on Paint, Varnish, and Related Products.

Apart from his technical interests, he was also interested in the niceties of English expression which fitted him admirably for the chairmanship of Committee E-8 on Nomenclature and Definitions, in which capacity he served from the organization of the committee in 1920.

One of his greatest contributions was in the administration of the Society's affairs. He was a member of the Executive Committee during many years of expansion of the Society's activities for in addition to his term as member, he also served as Vice-President and subsequently as President 1932–1933. In 1929 he was called upon to help organize the Society's new and important Committee E-10 on Standards, of which committee he also served as chairman during 1933 and 1934 and from 1935 to 1939.

But the reason for Mr. Chapman standing so high in our affection and esteem was his human qualities. He was always ready to be of assistance; he took a special interest in guiding and advising juniors in assuming responsibilities. His creed and guiding motive in all his actions were that we pass this way only once and that we should make the most of our opportunities in being helpful to others. Little wonder that his passing is felt so deeply by all who knew him!

PROFESSIONAL CARDS

On this page are announcements by leading organizations and individuals of their services for testing, research, and consulting work.

Professional Cards will be accepted for inclusion on this page from Consulting Engineers, Metallurgists, Chemists, Testing Engineers, and Testing Laboratories

PATZIG TESTING LABORATORIES

ENGINEERING INSPECTION
TESTS · ANALYSES · RESEARCH
—OF—
EQUIPMENT · APPLIANCES
MATERIALS & PRODUCTS

Ingersoll Ave. & 23rd St. Des Moines, Iowa

SOUTHWESTERN LABORATORIES

Consulting, Analytical Chemists and Testing Engineers

Inspections, Testing and Chemical Work

Fort Worth, Dallas, Houston,
Corpus Christi, and
San Antonio, Texas

W. B. COLEMAN & CO.

Metallurgists-Chemists-Engineers

Spectroscopic Analysis
Chemical and Physical Testing
Metallurgical Investigations
Boiler Water Conditioning
Consultation Service

9th & Rising Sun Ave., Philadelphia, Pa.

UNITED STATES TESTING CO. INC.

HOBOKEN, N. J.
Scientific Testing
Research Analysis
EST. 1880
Consultation and Inspection Service
PHILA.•N. Y.•CHICAGO•BOSTON•WOONSOCKET

THE WAYNE LABORATORIES

Chemists Bacteriologists
Consulting Engineers

Technical Service and Research for Industry
Metallurgy, Paints, Bitumens, Oils, Ceramics, Cement and Concrete, Inorganic and General
Physical Testing, Technical Photography, Microscopy, Waterworks, Sewage, Waste Disposal

17 E. Main St. Waynesboro, Pa.

THE JAMES H. HERRON COMPANY

Engineers, Chemists, Metallurgists
Consulting, Inspecting, Testing
Physical, Chemical, Metallographical & X-Ray Laboratories

1360–1364 West Third St., Cleveland, Ohio

PHILIP TUCKER GIDLEY

Synthetic Rubber

Physical and chemical testing, research, formulae and product development.

FAIRHAVEN, MASS.

FOSTER D. SNELL, INC.

Chemists — Engineers

Our chemical, engineering, bacteriological and medical staff with completely equipped laboratories are prepared to render you

Every Form of Chemical Service

306 Washington Street Brooklyn 1, N. Y.

PLASTICS INSTITUTE

Consulting, Testing, Plastics Research

Injection and compression presses, fabricating machinery, A.S.T.M. flowtester, complete physical testing equipment, and chemical equipment.

Laboratory: 186 S. Alvarado St., Los Angeles;
Branch Offices } 122 E. 42nd Street, New York
} 221 N. LaSalle Street, Chicago

ELECTRICAL TESTING LABORATORIES INC.

Field and Laboratory Tests
Electrical • Mechanical • Physical
Chemical

INSPECTION • ANALYSIS • RESEARCH
CERTIFICATION

2 East End Avenue at 79th St.,
New York 21, N. Y.

SAMPLERS — ANALYSTS

ASSAYING
CRYSTALLOGRAPHY
CORROSION STUDIES
CONSULTANTS
MINERALOGY
RESEARCH
SPECTROGRAPHY

Metallurgical Chemists and Engineers

LUCIUS PITKIN, Inc.
Pitkin Bldg.
47 Fulton St., N. Y. 7, N. Y.

A. W. WILLIAMS INSPECTION COMPANY

Timber and Timber Treatment Inspections

•

Also

Complete Chemical and Physical Testing Laboratories

EXECUTIVE OFFICE: Mobile, Alabama
BRANCH OFFICES: New York, N. Y., St. Louis, Mo.

South Florida Test Service

– Established 1931 –

Testing - Inspection - Research - Consultants

Development and testing of materials and products for predetermination of durability and permanency by actual exposure or service test.

P. O. Box 387
Miami 3, Florida.

"The Nations' Proving Ground For Better Materials & Products"

LEDOUX & COMPANY, INC.

Chemists, Assayers, Engineers
Samplers and Weighers

155 SIXTH AVE.
NEW YORK, N. Y.

Shilstone Testing Laboratory

INSPECTING AND CONSULTING
CHEMISTS & ENGINEERS
CARGO SURVEYORS

New Orleans, La. Houston, Tex.
Corpus Christi, Tex. San Antonio, Tex.
Mt. Pleasant, Tex. Jackson, Miss.

Inspection at all Leading Industrial Centers

ROBERT W. HUNT COMPANY ENGINEERS

Inspection, Tests, Consultation, Research

CHEMICAL, PHYSICAL, X-RAY, METALLURGICAL, CEMENT and CONCRETE LABORATORIES.

175 W. Jackson Blvd., CHICAGO, *And All Large Cities*

Metallurgists Chemists

NEW YORK TESTING LABORATORIES, INC.

80 WASHINGTON STREET, NEW YORK CITY

Consulting and Research Engineers

Mechanical, Physical and Electrical Tests, Inspections on all materials.

The Oldest Commercial Laboratory in America

BOOTH, GARRETT & BLAIR

Established 1836

Analytical and Consulting Chemists
Samplers and Weighers

228 South Ninth Street Philadelphia, Pa.